

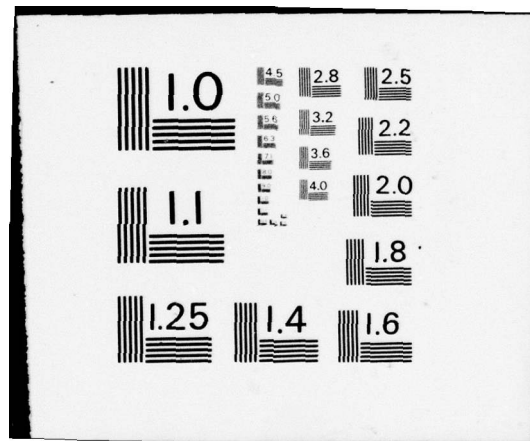
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A COMPUTER GENERATED PLOTTING CAPABILITY FOR FAMILIES OF CURVES--ETC(U)
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6
A COMPUTER GENERATED PLOTTING CAPABILITY FOR
FAMILIES OF CURVES IN 2 AND 3 DIMENSIONS,

by
10 L. E. McCleary
Transducer & Array Systems Division

Sponsored by NAVSHIPS Code 9012

12 64p.

11
August 1971
San Diego, California

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ABSTRACT

A concept is presented which facilitates the production of computer generated plots of families of curves in either 2 or 3 dimensions. Specific computer examples provided are intended to serve as master programs from which a wide variety of general purpose scientific plotting applications can be performed with a minimum amount of effort.

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ACKNOWLEDGEMENTS

I wish to thank numerous people who have contributed to the evolution of these programs. In particular, Don Barach and Bruce Wood also of the Transducer and Array Systems Division have used these programs and have offered many helpful suggestions. Also, I wish to express my appreciation to Ian Hirschsohn and Peter Preuss of Integrated Software Systems Corporation for their interest in providing improvements to the DISSPLA software package.

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SECTION 1.

INTRODUCTION

For many years digital computers have been used to implement math models of various physical systems. However, once the delight of obtaining correct numerical printouts from mammoth digital calculations has passed, it has often been an additional burden to effectively and inexpensively display the results in forms such that the scientist can gain additional insight into the behavior of the system he is studying. In order to alleviate this problem there have been numerous digital plotting systems developed which are capable of producing any graph imaginable by the scientist. However, all too frequently the scientist is hampered by various roadblocks which usually exist in such endeavors. First of all, the lead time required to program new plot configurations can often be on the order of days. This lag time in itself can be sufficient to discourage the innovative scientist, without even considering the manpower costs involved. This paper is a description of work performed by the author in order to minimize these bottlenecks and to maximize responsiveness to the needs of scientific projects. This work has been performed by the NUC Transducer and Array Systems Division; however, its generality should be applicable to a wide variety of other scientific projects.

In order to implement the concept to be demonstrated in the paper, the following two items are required:

1. A highly responsive Computer Center with plotting hardware, and
2. A high level user-oriented graphics computer language.

At NUC the items are satisfied by the following:

(a) either the UNIVAC 1230/490 systems with their associated Calcomp 565 and 1136 plotters, or the UNIVAC 1108 and its associated Calcomp 663, and

(b) the Fortran software system DISSPLA* as implemented on the NUC UNIVAC computers mentioned above.

The concept which serves as the basis for the examples to be shown involves a data storage scheme well suited to the problem of either producing families of curves in 2 dimensions, or producing the same information as a perspective view in 3 dimensions. By combining the simplicity of the data storage scheme with the many powerful features of DISSPLA it has been possible to produce highly versatile plotting samples which can be modified for various applications with a minimum amount of effort.

The computer examples to be presented in this paper are as follows:

1. PLT FAM for plotting families of curves in 2 dimensions
2. PLT SRF for 3 dimensional plotting of either families of curves or surfaces
3. PLT PTN, a modified version of PLT FAM specifically oriented towards polar plot applications.

For each example, the data storage scheme will be outlined, the program options will be explained, and the associated computer printout and plots will be included.

* DISSPLA PLOTTING SYSTEM MANUALS, Integrated Software Systems Corp., San Diego, California.

SECTION 2.

COMPUTER PROGRAMMING CONSIDERATIONS

The programs have been developed on the NUC UNIVAC 1230 computer using ASA Fortran with two exceptions, SFLD and ENCODE. In order to run the programs on the NUC UNIVAC 1108, several Fortran statements (marked in the decks by having "1230" in columns 73-76) must be changed as shown in Fig. 2.1. Similar changes would be required on any other computer system using the DISSPLA package. Actually the statements requiring SFLD (FLD on the 1108) can be eliminated, if desired, since they are used only to provide a safety factor in case the user fails to terminate one of the self-counting title strings properly.

Even though all three examples were originally developed on the 1230, the PLT SRF example will be for the 1108, since the current version of the DISSPLA 3D software is too large for the 1230 when using all of the options demonstrated. PLT SRF can be run on the 1230 if several of the options are deleted.

In order to implement new applications the user must first of all select a data input medium. Although this could involve direct computation of the function to be plotted, it is frequently advisable or necessary to load pre-computed values from tape or cards as shown in the examples. Once the input medium has been selected, the user must then tailor the data input section of the CONTROL ROUTINE to the needs of his problems and also select the appropriate options for his needs from one of the three examples.

C * * * * * NUC UNIVAC 1230 STATEMENTS * * * * *

	DATA N WRD P C /16/	Q WORDS PER CARD IMAGE ON UNIVAC	1230
	DATA IDOLAR/5H \$ /		1230
	CALL SFLD(24, 6, I HEAD(12,J), IDOLAR)		1230
200	FORMAT(16A5)		1230
201	FORMAT(1X, 16A5)		1230
	CALL SFLD(24, 6, IHD LPT(6), IDOLAR)		1230
	CALL SFLD(24, 6, IHD MEM(6), IDOLAR)		1230
	CALL SFLD(24, 6, IHDFAM(12,N), IDOLAR)		1230
	COMMON / CM PLOT / I BUF(200)	SET	
	DATA NBUF / 200 /	SET	
	DATA I PLT UN / 2 /	SET	
	DATA IDOLAR/5H \$ /		1230
	CALL SFLD(24, 6, IHDFAM(12,N), IDOLAR)		1230
4990	FORMAT(/' COMPLETED PLOT NO.', I3, ' *** ', 12A5 /		1230

C * * * * * NUC UNIVAC 1108 STATEMENTS * * * * *

	DATA N WRD P C /14/	Q WORDS PER CARD IMAGE ON UNIVAC	1108
	DATA IDOLAR/6H \$ /		1108
	FLD(30, 6, I HEAD(12,J)) = I DOLAR		1108
200	FORMAT(13A6,A2)		1108
201	FORMAT(1X, 13A6,A2)		1108
	FLD(30, 6, IHD LPT(6)) = I DOLAR		1108
	FLD(30, 6, IHD MEM(6)) = I DOLAR		1108
	FLD(30, 6, IHD FAM(12,N)) = I DOLAR		1108
	COMMON / CM PLOT / I BUF(2000)	SET	
	DATA NBUF / 2000 /	SET	
	DATA I PLT UN / 8 /	SET	
	DATA IDOLAR/6H \$ /		1108
	FLD(30, 6, IHD FAM(12,N)) = I DOLAR		1108
4990	FORMAT(/' COMPLETED PLOT NO.', I3, ' *** ', 12A6 /		1108

FIG 2.1 - FORTRAN STATEMENTS TO BE CHANGED FROM 1230 VERSION
TO PRODUCE 1108 VERSION OF PLT FAM
(SIMILAR REQUIREMENTS FOR PLT SRF AND PLT PTN)

SECTION 3.

PLT FAM

PLT FAM is designed for plotting families of curves in 2 dimensions with the following features:

1. Option for user selected axis scales or automatic self scaling via DISSPLA
2. User supplied headings, axis labels, and legend labels
3. Choice of linear, log-log, log-linear, or linear-log
4. Option to combine two consecutive families of curves onto the same grid

The data storage scheme for the X, Y data points is illustrated in Fig. 3.1, where NFAMILY is the number of families of curves, MEMBER is the number of members per family, and LPTS is the number of points per member of the family. Comments at the beginning of the PLT FAM subroutine explain the array sizes required.

Detailed line by line descriptions of the programs will not be given since an attempt has been made to provide sufficient comments within the Fortran programs.

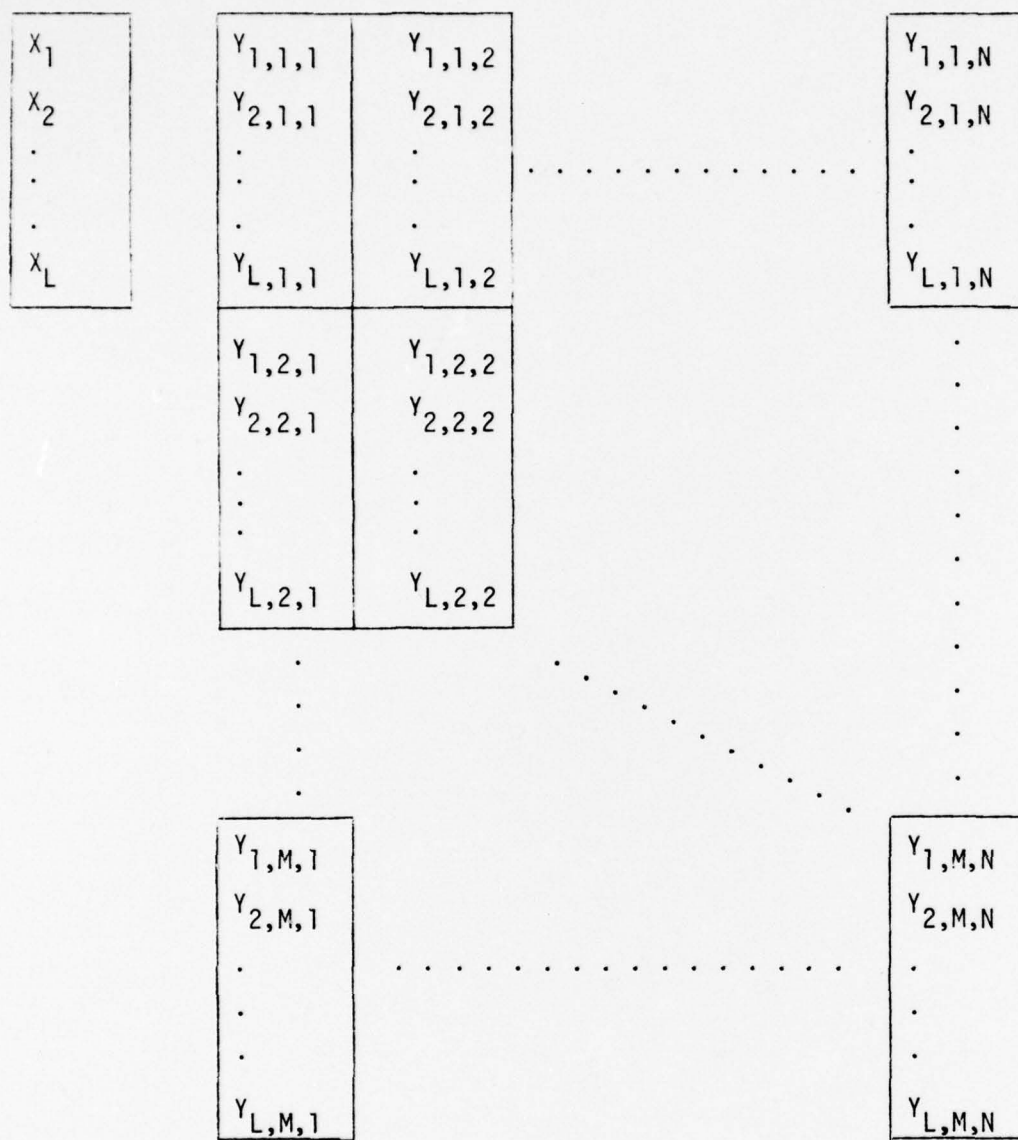


FIG. 3.1 PLT FAM data storage scheme for $X(L)$ and $Y(L,M,N)$
(where $L = \text{LPTS}$, $M = \text{MEMBER}$, $N = \text{NFAMILY}$)

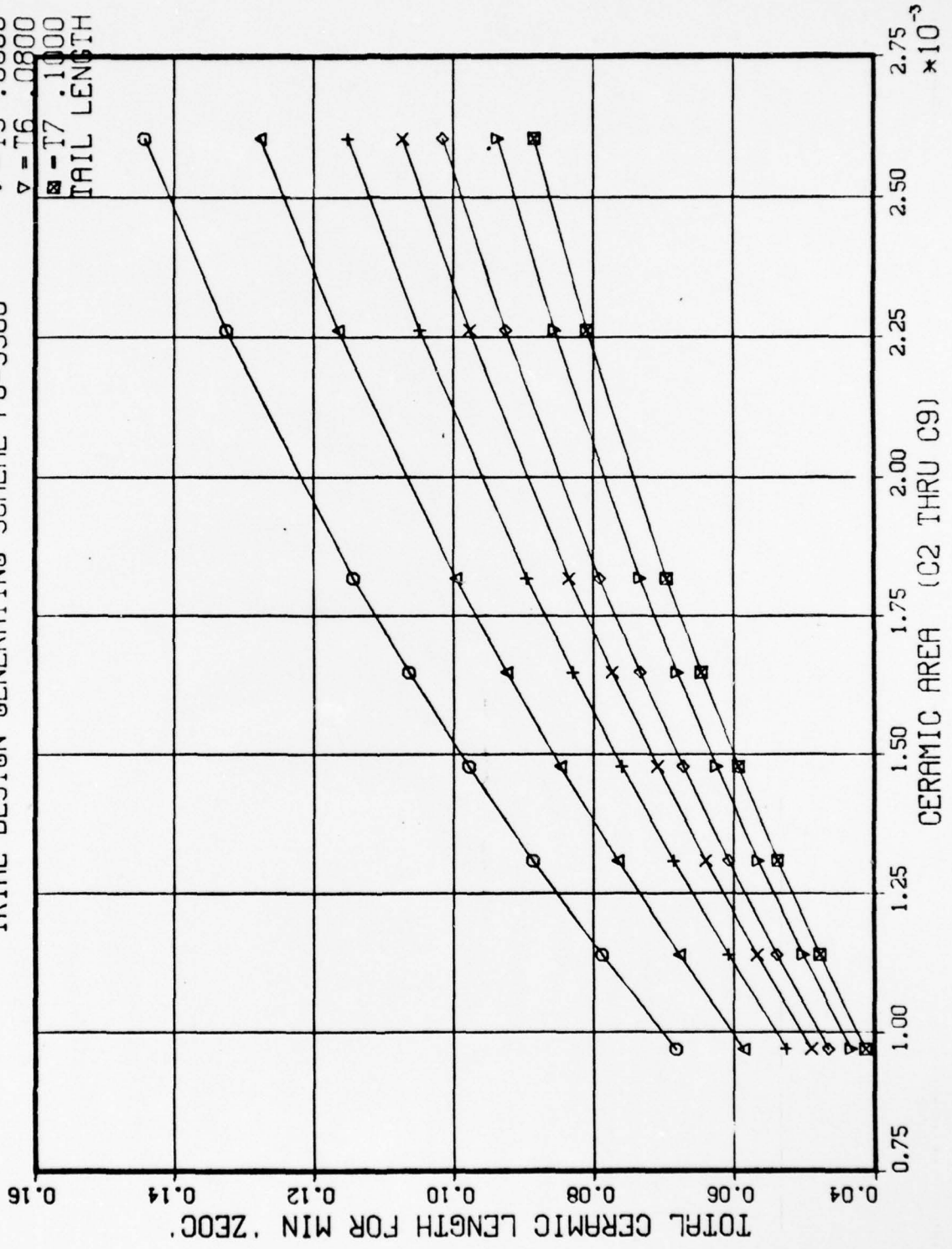
SECTION 3.1

PLT FAM plotting samples

SEADUCER RUN 80122 MAY 6, 1971
 IP 2.3 DESIGN RUN WITH LOSSLESS HEAD
 TRIAL DESIGN GENERATING SCHEME FO-5500

LEGEND

- - T1 .0200
 - △ - T2 .0292
 - + - T3 .0400
 - x - T4 .0500
 - ◇ - T5 .0600
 - ▽ - T6 .0800
 - - T7 .1000
- TAIL LENGTH



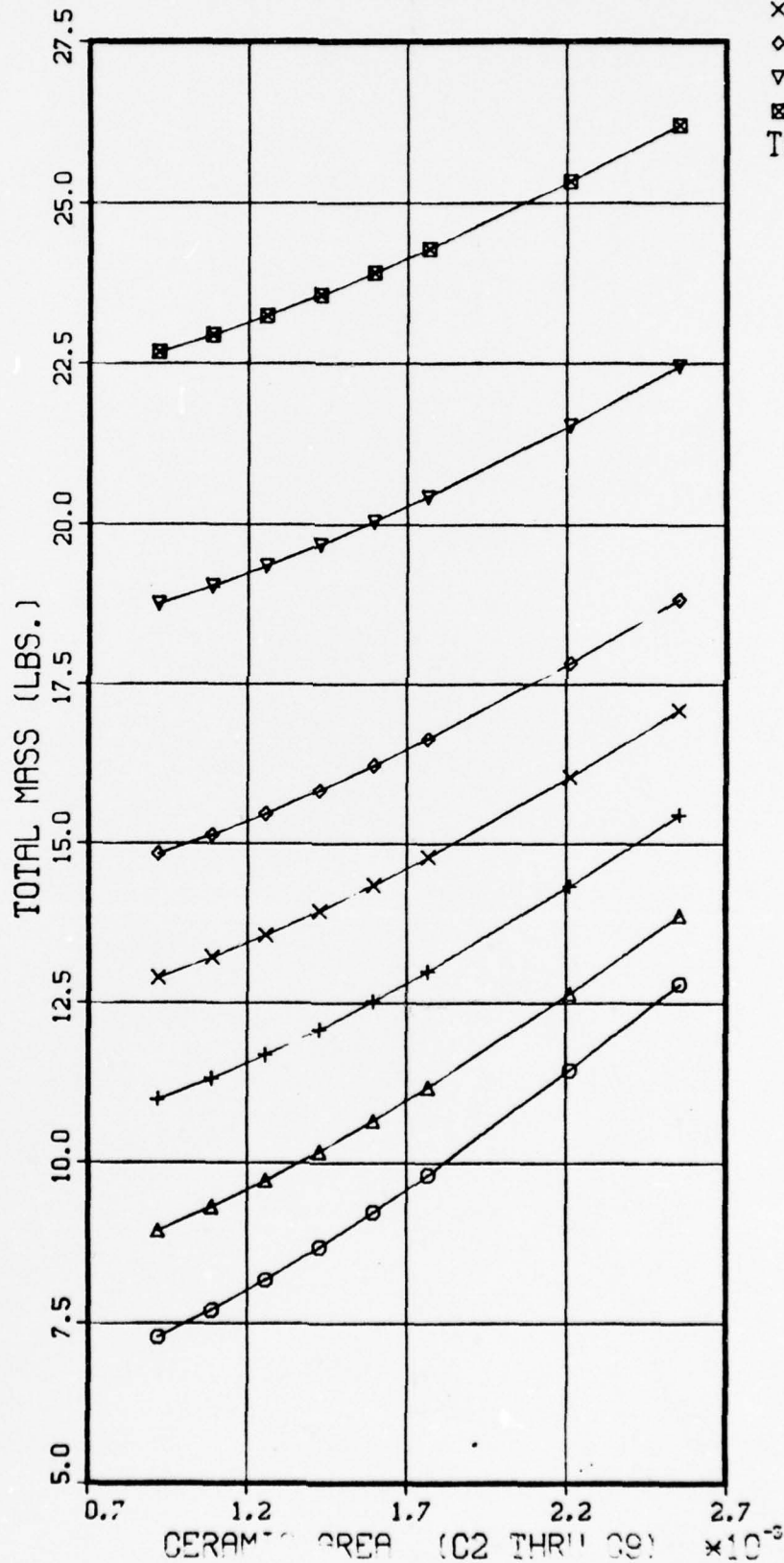
SEADUCER RUN 80122 MAY 6, 1971

IP 2.3 DESIGN RUN WITH LOSSLESS HEAD

TRIAL DESIGN GENERATING SCHEME FO=5500+

LEGEND

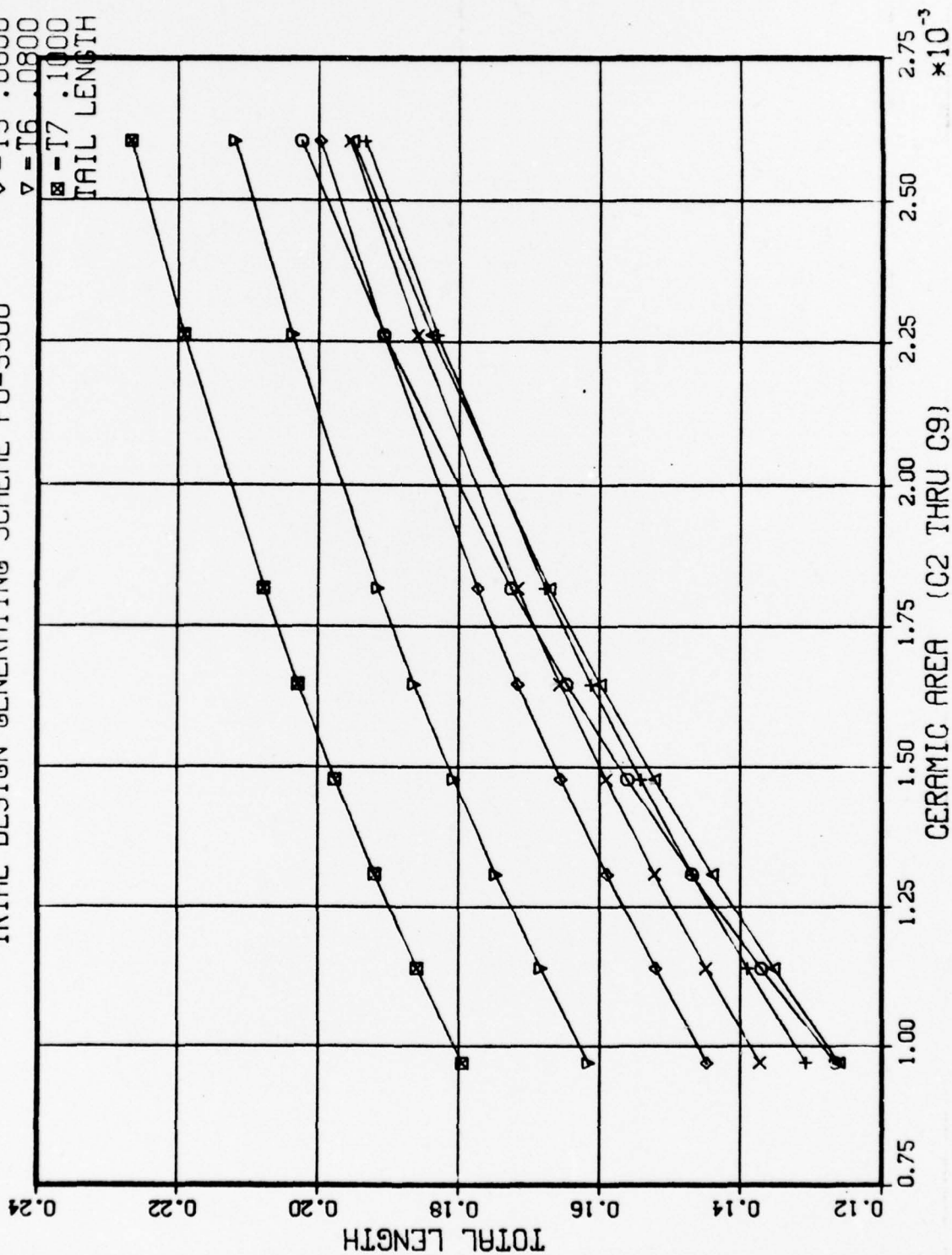
○ - T1 .0200
 △ - T2 .0292
 + - T3 .0400
 × - T4 .0500
 ◇ - T5 .0600
 ▽ - T6 .0800
 ■ - T7 .1000
 TAIL LENGTH



SEADUCER RUN 80122 MAY 6, 1971
 IP 2.3 DESIGN RUN WITH LOSSLESS HEAD
 TRIAL DESIGN GENERATING SCHEME FO-5500

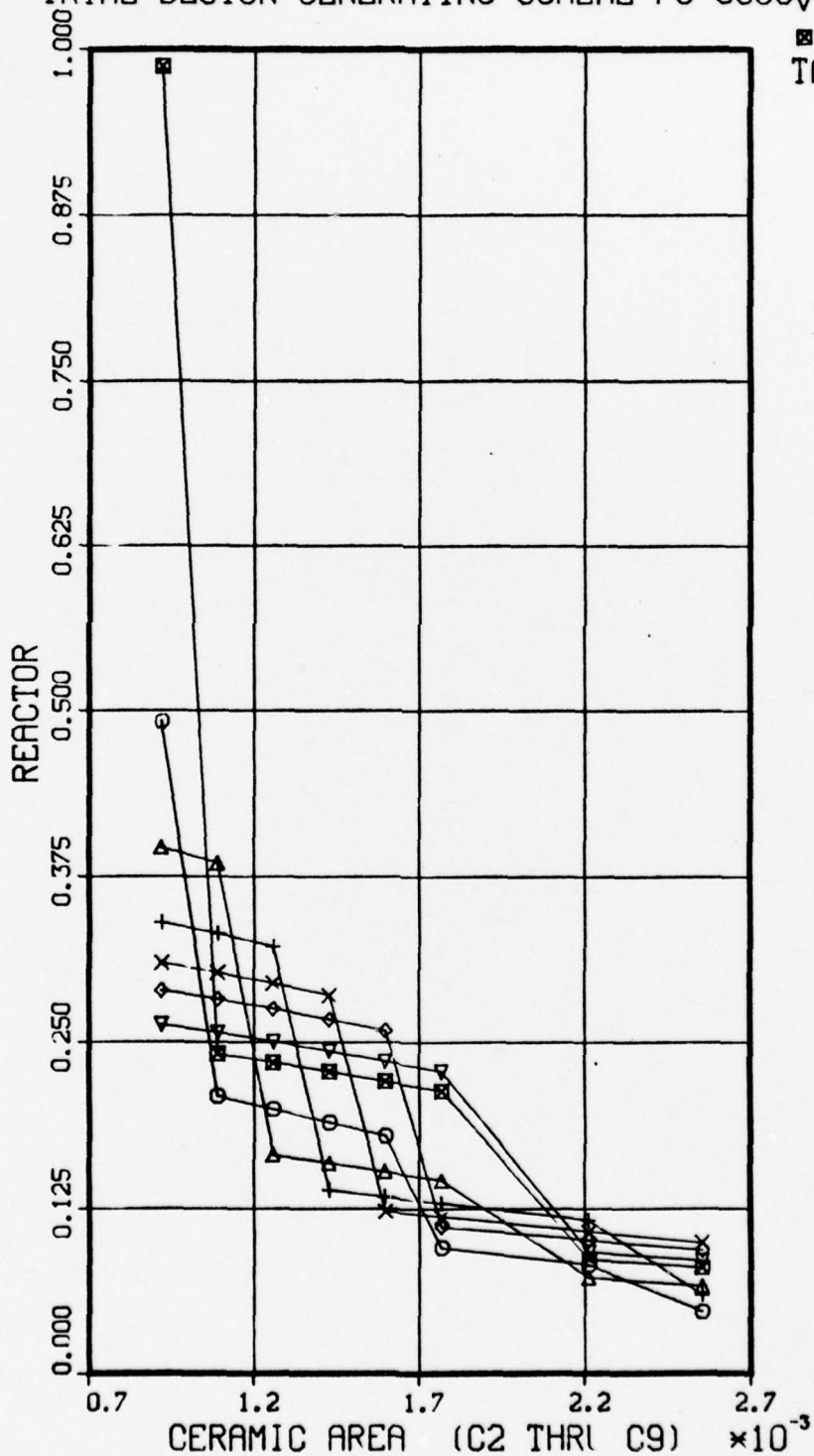
LEGEND

- - T1 .0200
- △ - T2 .0292
- + - T3 .0400
- x - T4 .0500
- ◇ - T5 .0600
- ▽ - T6 .0800
- ⊠ - T7 .1000
- TAIL LENGTH



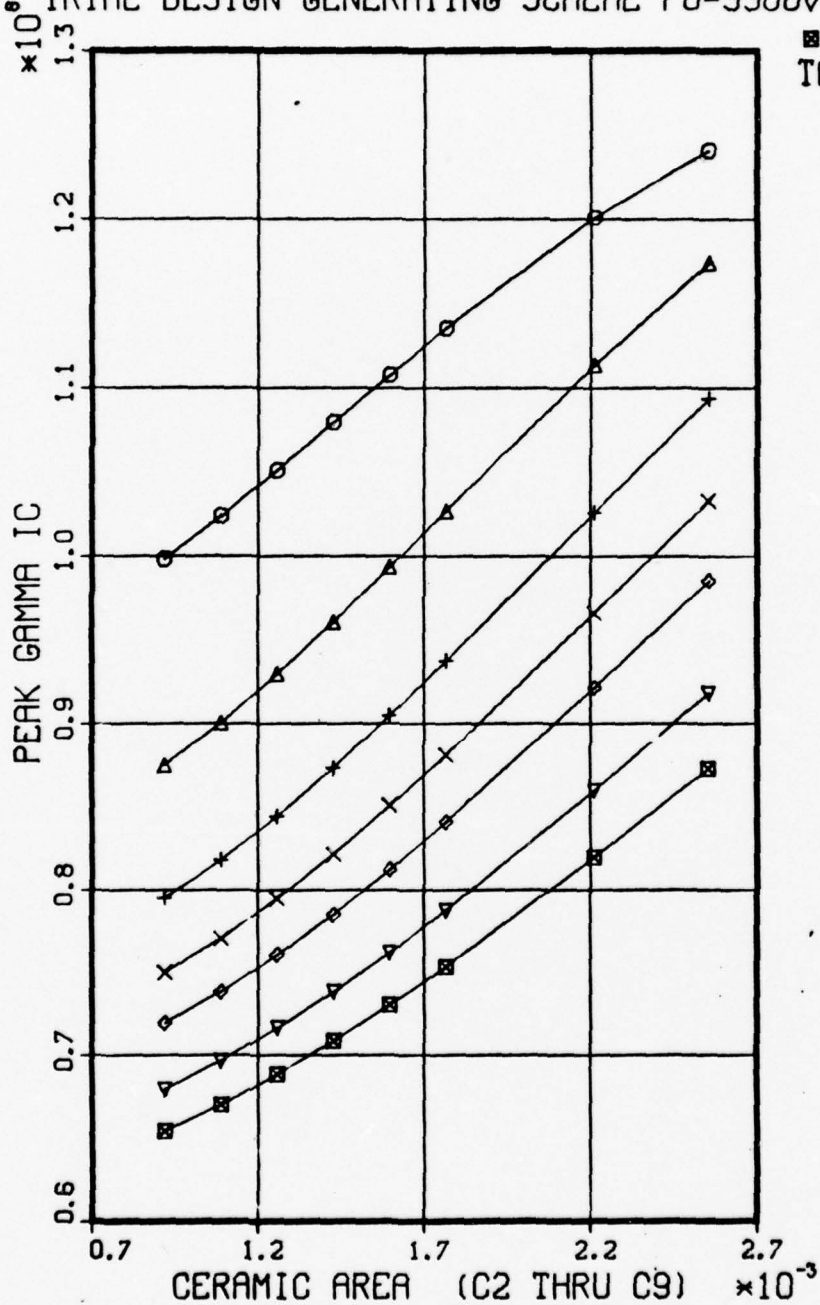
SEADUCER RUN 80122 MAY 6, 1971
 IP 2.3 DESIGN RUN WITH LOSSLESS HEAD
 TRIAL DESIGN GENERATING SCHEME FO-5500

LEGEND
 ○ - T1 .0200
 △ - T2 .0292
 + - T3 .0400
 × - T4 .0500
 ◇ - T5 .0600
 ▽ - T6 .0800
 ■ - T7 .1000
 TAIL LENGTH



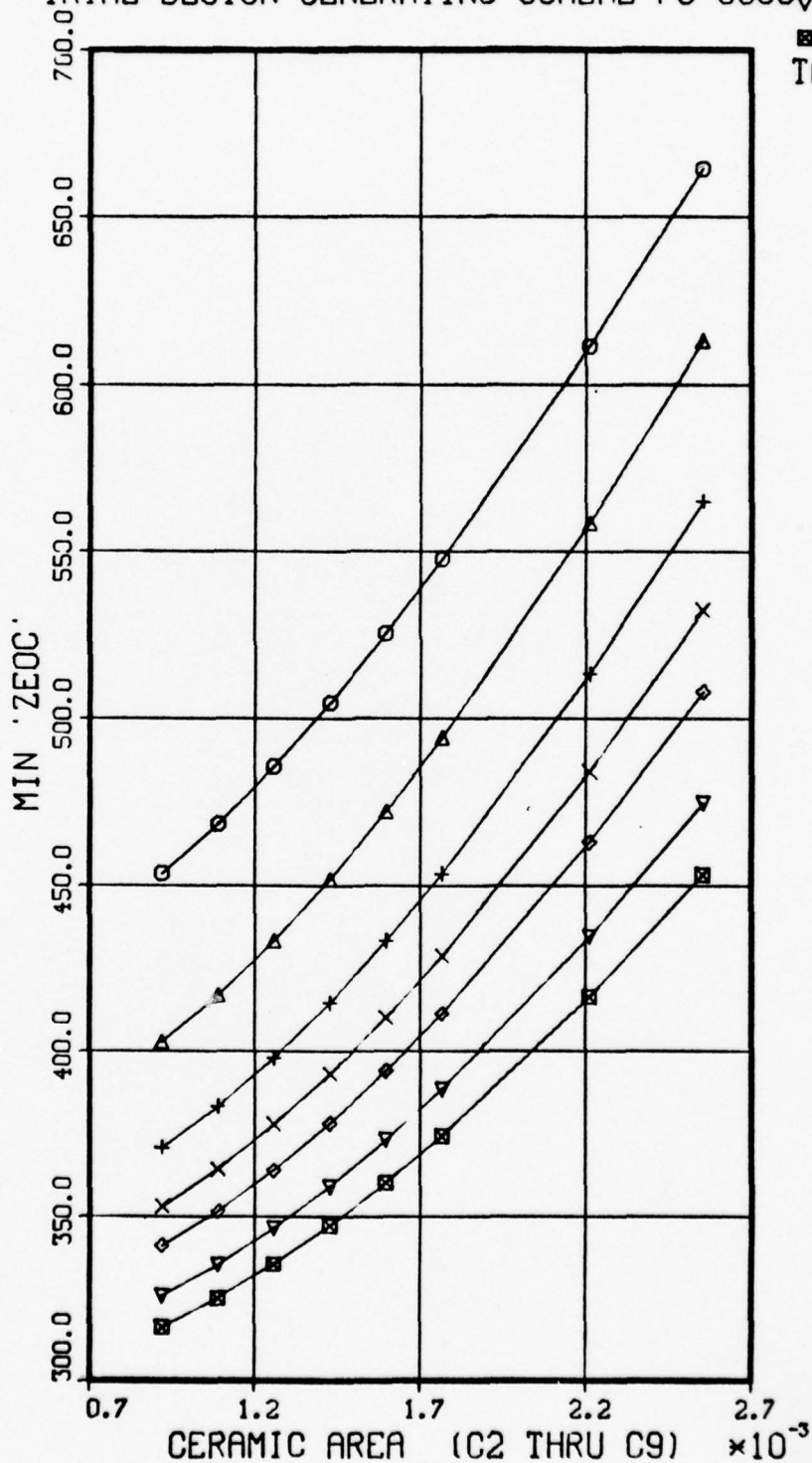
SEADUCER RUN 80122 MAY 6, 1971
 IP 2.3 DESIGN RUN WITH LOSSLESS HEAD
 TRIAL DESIGN GENERATING SCHEME FO-5500

LEGEND
 ○ - T1 .0200
 △ - T2 .0292
 + - T3 .0400
 × - T4 .0500
 ◇ - T5 .0600
 ▽ - T6 .0800
 ■ - T7 .1000
 TAIL LENGTH



SEADUCER RUN 80122 MAY 6, 1971
 IP 2.3 DESIGN RUN WITH LOSSLESS HEAD
 TRIAL DESIGN GENERATING SCHEME FO-5500

LEGEND
 ○ - T1 .0200
 △ - T2 .0292
 + - T3 .0400
 × - T4 .0500
 ◇ - T5 .0600
 ▽ - T6 .0800
 ■ - T7 .1000
 TAIL LENGTH



SECTION 3.2

PLT FAM program listing

2000 JOB 601 ~~1005-501~~ 00.04 L MCCLEARY PLT FAM 80122DS6N
MOUNT M3S=PLOT
FORTRAN

C * * * * * PLT FAM CONTROL ROUTINE * * * * *
COMMON / / XDATA(30), YDATA(30,12,6)
COMMON / CMHEAD / IHD LPT(6), IHD MEM(6), IHDFAM(12, 6), IHFAD(12,3)
COMMON / NUMS / LPTS, MEMBER, NFAMILY, NHLINS
COMMON / CPL LRL / DTA LRL(12,2), IPK LRL(12,12)
DIMENSION I CHK(16)
DATA N WRD P C /16/ Q WORDS PER CARD IMAGE ON UNIVAC 1230
DATA IDOLAR/5H \$ / 1230
DATA IN UNIT / 5 /

C***** USER SETS NHLINS = NUMBER OF HEADING LINES TO BE LOADED
NHLINS = 3

C***** LOAD IHEAD FOR PLOT HEADINGS
DO 4100 J = 1,NHLINS
READ(IN UNIT, 200) (IHEAD(I,J), I=1,12)
CALL SFLD(24, 6, I HEAD(12,J), IDOLAR) 1230
PRINT 201 , (IHEAD(I,J), I=1,12)

4100 CONTINUE

C***** READ AND PRINT ANY EXTRA INFORMATION IF DESIRED

READ(IN UNIT, 200) (I CHK(I), I=1,N WRD P C)
PRINT 201 , (I CHK(I), I=1,N WRD P C)
READ(IN UNIT, 200) (I CHK(I), I=1,N WRD P C)
PRINT 201 , (I CHK(I), I=1,N WRD P C)
200 FORMAT(16A5) 1230
201 FORMAT(1X, 16A5) 1230

C***** USER LOADS INPUT DATA FOR LPTS, MEMBER, NFAMILY, X, Y, DTA LRL

POUNDS = 2.20462
LPTS = 8
MEMBER = 7
NFAMILY = 6
DO 9 M = 1, MEMBER
DO 8 L = 1, LPTS
READ(5,100) DTALBL(M,1), DTALBL(M,2), XDATA(L),
1 (YDATA(L,M,N), N=1,NFAMILY)
PRINT 101, DTALBL(M,1), DTALBL(M,2), XDATA(L),
1 (YDATA(L,M,N), N=1,NFAMILY)
100 FORMAT(1X,A2, 4X,3F8.6,3X,F8.4,F8.5,3E10.4)
101 FORMAT(1X, 1X,A2, 4X,3F8.6,3X,F8.4,F8.5,3E10.4)
DO 10 N = 1,NFAMILY
IF (N.EQ. 2) YDATA(L,M,N) = Y DATA(L,M,N) * POUNDS
10 CONTINUE
8 CONTINUE
9 CONTINUE

C***** LOAD IHD LPT FOR X AXIS TITLE

READ(IN UNIT, 200) (IHD LPT(I), I=1,6)
CALL SFLD(24, 6, IHD LPT(6), IDOLAR) 1230
PRINT 201 , (IHD LPT(I), I=1,6)

C***** LOAD IHD MEM FOR LEGEND TITLE

READ(IN UNIT, 200) (IHD MEM(I), I=1,6)
CALL SFLD(24, 6, IHD MEM(6), IDOLAR) 1230
PRINT 201 , (IHD MEM(I), I=1,6)

C***** LOAD IHD FAM FOR INDIVIDUAL PLOTS (Y AXIS)

DO 4000 N = 1,NFAMILY
READ(IN UNIT, 200) (IHD FAM(I,N), I=1,12)
CALL SFLD(24, 6, IHDFAM(12,N), IDOLAR) 1230

```
PRINT          201 , (IHD FAM(I,N), I=1,12)
4000 CONTINUE
```

```
C * * * * * INPUT IS NOW LOADED * * * * *
CALL PLT FAM
```

```
C * * * * * TERMINATE ENTIRE PLOT RUN * * * * *
CALL PLOT(0., 0., 999)
STOP
END
```

```

SUBROUTINE PLT FAM
C * * * * * PLT FAM (USING DISSPLA PACKAGE) * * * * *
C * * * * * GENERAL PROGRAM TO PLOT FAMILIES OF CURVES WITH LEGENDS * * * * *
C * * * * * PROGRAMMED BY L. E. MCCLEARY NUC CODE 601 * * * * *

C * * * * * DIMENSION AS FOLLOWS * * * * *
C * * * * * WHERE L=LPTS, M=MEMBER, N=NFAMILY, H=NHLINS
C * * * * * LOAD COMMONS / /, /CMHEAD/, /NUMS/, AND ARRAY DTA LBL IN CONTROL
C * * * * * LOAD COMMONS /P CMBIN/, /PL FORM/, IN THIS ROUTINE IF NEEDED
C      COMMON /      / XDATA(L), YDATA(L,M,N)
C      COMMON / CMHEAD / IHDLPT(6), IHDMEM(6), IHDFAM(12, N), IHEAD(12,H)
C      COMMON / NUMS   / LPTS, MEMBER, NFAMILY, NHLINS
C      COMMON / CPL LBL / DTA LBL( M,2), IPK LBL( M,12)
C      COMMON / NO LOAD / YMIN(N), YMAX(N), YPLOT(L)
C      COMMON / P CMBIN / N CMBIN(N)
C      COMMON / PL FORM / N FORM(N)      @ LIN-0, LOG-1, XLG-2, YLG-3

      COMMON /      / XDATA( 30), YDATA( 30,12,6)
      COMMON / CMHEAD / IHDLPT(6), IHDMEM(6), IHDFAM(12, 6), IHEAD(12,3)
      COMMON / NUMS   / LPTS, MEMBER, NFAMILY, NHLINS
      COMMON / CPL LBL / DTA LBL(12,2), IPK LBL(12,12)
      COMMON / NO LOAD / YMIN(6), Y MAX(6), Y PLOT(30)
      COMMON / P CMBIN / N CMBIN(6)
      COMMON / PL FORM / N FORM(6)      @ LIN-0, LOG-1, XLG-2, YLG-3

COMMON/ QOEXTR / XOR, XSTEP, YOR, YSTEP, X AXIS, Y AXIS, LX,LY,IT

DIMENSION IH LBL M(4)

COMMON / CM PLOT / I BU( 200)
DATA NBU / 200 /
DATA IFTF/0/
DATA I PLT UN / 2 /
DATA IDOLAR/5H $ /

PRINT 1
1 FORMAT(1H1)

C * * * * * INITIALIZE PLOT BUFFER
IF(IFTF.EQ. 0) CALL PLOTS(IBUF,NBU, I PLT UN)
IFTF=1
C      CALL FACTOR(.85)      @ REDUCE 8 1/2 BY 11 TO VIEW GRAPH SIZE

C * * * * * FIND MAX MIN OVER ALL MEMBERS FOR EACH FAMILY
DO 500 N = 1, NFAMILY
  Y MIN(N) = 1.E30
  Y MAX(N) = -1.E30
C***** USER SETS N FORM(N) =0,1,2,3 FOR LIN, LOG, XLG OR YLG PLOTS
  N FORM(N) = 0

C***** USER SETS N CMBIN(N) = 1 TO PLOT FAMILIES N AND N+1 ON SAME GRID
  N CMBIN(N) = 0

500 CONTINUE

DO 3000 L = 1, LPTS
DO 2000 M = 1, MEMBER
DO 1000 N = 1,NFAMILY
IF ( Y DATA(L,M,N) .LT. Y MIN(N) ) Y MIN(N) = Y DATA(L,M,N)
IF ( Y DATA(L,M,N) .GT. Y MAX(N) ) Y MAX(N) = Y DATA(L,M,N)

```

```

1000 CONTINUE
2000 CONTINUE
3000 CONTINUE

C * * * * * USE DISSPLA PACKAGE * * * * *

C * * * * * LOOP ON N FROM 1 TO NFAMLY * * * * *
  NTH PLT = 0
  N = 0
4999 N = N + 1
  NTH PLT = NTH PLT + 1

  IF ( N CMBIN(N) .EQ. 0 ) GO TO 4101
  IF ( Y MIN(N+1) .LT. Y MIN(N) ) Y MIN(N) = Y MIN(N+1)
  IF ( Y MAX(N+1) .GT. Y MAX(N) ) Y MAX(N) = Y MAX(N+1)
  DO 4100 N HEAD = 1, 6
    IHDFAM(NHEAD+6,N) = IHDFAM(NHEAD,N+1)
4100 CONTINUE
  CALL SFLD( 24, 6, IHDFAM(12,N), IDOLAR )
4101 CONTINUE

  CALL RGNPL( -NTH PLT )
  M = 1
  DO 4400 L = 1, LPTS
4400 Y PLOT(L) = Y DATA(L,M,N)

C***** USER SETS I SCALE = 0 FOR SELF SCALING
C***** USER SETS I SCALE = 1 FOR USER SUPPLIED SCALES
  I SCALE = 1
  I SCALE = 0

  IF ( I SCALE .EQ. 0 ) GO TO 4440

C***** FOR USER SUPPLIED SCALES,
C***** USER SETS X AXIS, Y AXIS, XOR, YOR, XSTEP, YSTEP FOR EACH FAMILY

  GO TO 4445

4440 CONTINUE
C * * * * * SELF SCALING TO RETURN VARIABLES IN DISSPLA COMMON /QQEXTR/
  CALL HLDPLT
  CALL X RANGE( X DATA(1), X DATA(LPTS) )
  CALL Y RANGE( Y MIN(N), Y MAX(N) )
  IF ( N FORM(N) .EQ. 0 ) CALL LINPLT( XDATA, YPLOT, LPTS )
  IF ( N FORM(N) .EQ. 1 ) CALL LOGPLT( XDATA, YPLOT, LPTS )
  IF ( N FORM(N) .EQ. 2 ) CALL XLGPLT( XDATA, YPLOT, LPTS )
  IF ( N FORM(N) .EQ. 3 ) CALL YLGPLT( XDATA, YPLOT, LPTS )

4445 CONTINUE
C * * * * * SCALES ARE NOW AVAILABLE FOR PLOTTING
  ITITLE = 1
  IF ( X AXIS .GT. Y AXIS ) ITITLE = -1
  CALL TITLE(1H, ITITLE, IHDLPT, 100, IHDFAM(1,N), 100, X AXIS, Y AXIS)
  IF ( N FORM(N) .EQ. 0 ) CALL GRAPH (XOR, XSTEP, YOR, YSTEP)
  IF ( N FORM(N) .EQ. 1 ) CALL LOGLOG(XOR, XSTEP, YOR, YSTEP)
  IF ( N FORM(N) .EQ. 2 ) CALL X LOG (XOR, XSTEP, YOR, YSTEP)
  IF ( N FORM(N) .EQ. 3 ) CALL Y LOG (XOR, XSTEP, YOR, YSTEP)

  DO 4500 J = 1, NHLINS
4500 CALL HEADIN( IHEAD(1,J), 100, 2, NHLINS)
  CALL FRAME

```

```

CALL GRID( 1, 1 )

C   CALL SPLINE
    CALL MARKER( M )
    I MARK = 0
    I MARK = 1
    CALL CURVE( X DATA, Y PLOT, LPTS, I MARK )

C***** USER SELECTS LEGEND FORMAT FOR ENCODE
  4 FORMAT(A2, F6.4, '$')
    ENCODE(20, 4, IH LBL M) DTALBL(M,1), DTALBL(M,2)
    CALL LINES(IH LBL M, IPK LBL, M )

    IF ( MEMBER .EQ. 1 ) GO TO 4901
    DO 4900 M = 2, MEMBER
    DO 4600 L = 1, LPTS
4600 Y PLOT(L) = Y DATA(L,M,N)
    CALL MARKER(M)
    CALL CURVE( X DATA, Y PLOT, LPTS, I MARK )

    ENCODE(20, 4, IH LBL M) DTALBL(M,1), DTALBL(M,2)
    CALL LINES(IH LBL M, IPK LBL, M )
4900 CONTINUE
4901 CONTINUE

C***** USER SETS N LEGND = 0 FOR NO LEGEND
C***** USER SETS N LEGND = 1 FOR LEGEND
  N LEGND = 0
  N LEGND = 1

  IF ( N LEGND .EQ. 0 ) GO TO 4960
  XLEGND = X AXIS - 1.
  IF ( X AXIS .LT. 6. ) X LEGND = X AXIS + .25
  YLEGND = Y AXIS
  IF ( Y AXIS .GT. 8. ) Y LEGND = Y AXIS - .5
  IF ( ITITLE.NE.1 .AND. YAXIS.GT.5. ) YLEGND = YAXIS-.2
  CALL LEGEND(IPK LBL, MEMBER, XLEGND, YLEGND )
  CALL MESSAG( IHD MEM, 100, XLEGND, YLEGND-.2 )
4960 CONTINUE

  IF ( N CMBIN(N) .EQ. 0 ) GO TO 4980
  DO 4970 M = 1, MEMBER
  DO 4965 L = 1, LPTS
4965 Y PLOT(L) = Y DATA(L,M,N+1)
  CALL MARKER( M )
  CALL CURVE( X DATA, Y PLOT, LPTS, I MARK )
4970 CONTINUE
4980 CONTINUE

  CALL ENDPL( -NTH PLT )
  PRINT 4990, NTH PLT, (IHD FAM(I,N), I=1,12),
P      XOR,XSTEP,X AXIS, YOR,YSTEP,Y AXIS
4990 FORMAT(/' COMPLETED PLOT NO.', I3, ' *** ', 12A5 /
F      ' X', 2E10.4,F4.1, ' Y', 2E10.4,F4.1 /)

  IF ( N CMBIN(N) .EQ. 0 ) GO TO 5000
  N = N + 1

5000 IF ( N .LT. NFAMILY ) GO TO 4999

RETURN

```

END

SEND

\$DATA

SEADUCER RUN 80122 MAY 6,1971\$ LIKE 80089 Q=50

IP 2.3 DESIGN RUN WITH LOSSLESS HEADS

TRIAL DESIGN GENERATING SCHEME F0=5500 \$

CHARGE TO 16000501 ARRAY DESIGN

	L	T2L1	A	C3D	T	L	C3D	NP	T	MASS	T	LENGTH	REACTOR	GAMMA	IC	GAM	EC	MIN
T1C2	.020000	.000969	.068308	4	3.3061	.12655	.4923E 00	.9984E 06	.4536E 03									
T1C3	.020000	.001139	.078810	6	3.4973	.13705	.2095E 00	.1024E 07	.4686E 03									
T1C4	.020000	.001308	.088665	6	3.7102	.14690	.1907E 00	.1051E 07	.4857E 03									
T1C5	.020000	.001478	.097868	6	3.9421	.15611	.1897E 00	.1080E 07	.5048E 03									
T1C6	.020000	.001647	.106433	6	4.1905	.16467	.1798E 00	.1108E 07	.5255E 03									
T1C7	.020000	.001817	.114374	8	4.4531	.17261	.9567E-01	.1136E 07	.5478E 03									
T1C8	.020000	.002262	.132576	8	5.1965	.19082	.8253E-01	.1201E 07	.6113E 03									
T1C9	.020000	.002604	.144293	10	5.8091	.20253	.4718E-01	.1241E 07	.6644E 03									
T2C2	.029200	.000969	.058624	4	4.0579	.12606	.3969E 00	.8752E 06	.4028E 03									
T2C3	.029200	.001139	.067846	4	4.2249	.13529	.3853E 00	.9006E 06	.4169E 03									
T2C4	.029200	.001308	.076560	6	4.4116	.14400	.1654E 00	.9296E 06	.4334E 03									
T2C5	.029200	.001478	.084769	6	4.6160	.15221	.1592E 00	.9608E 06	.4519E 03									
T2C6	.029200	.001647	.092480	6	4.8360	.15992	.1528E 00	.9936E 06	.4723E 03									
T2C7	.029200	.001817	.099712	6	5.0700	.16715	.1464E 00	.1027E 07	.4943E 03									
T2C8	.029200	.002262	.116568	8	5.7386	.18401	.7299E-01	.1114E 07	.5586E 03									
T2C9	.029200	.002604	.127729	8	6.2971	.19517	.6631E-01	.1174E 07	.6129E 03									
T3C2	.040000	.000969	.052474	4	4.9809	.13071	.3405E 00	.7952E 06	.3708E 03									
T3C3	.040000	.001139	.060763	4	5.1318	.13900	.3321E 00	.8180E 06	.3833E 03									
T3C4	.040000	.001308	.068613	4	5.3006	.14685	.3227E 00	.8443E 06	.3980E 03									
T3C5	.040000	.001478	.076011	6	5.4853	.15425	.1388E 00	.8735E 06	.4148E 03									
T3C6	.040000	.001647	.082978	6	5.6844	.16122	.1340E 00	.9048E 06	.4334E 03									
T3C7	.040000	.001817	.089527	6	5.8963	.16777	.1291E 00	.9375E 06	.4536E 03									
T3C8	.040000	.002262	.104895	6	6.5037	.18314	.1162E 00	.1026E 07	.5134E 03									
T3C9	.040000	.002604	.115152	8	7.0129	.19339	.6003E-01	.1094E 07	.5651E 03									
T4C2	.050000	.000969	.048974	4	5.8525	.13721	.3098E 00	.7501E 06	.3530E 03									
T4C3	.050000	.001139	.056695	4	5.9941	.14493	.3028E 00	.7708E 06	.3644E 03									
T4C4	.050000	.001308	.064004	4	6.1524	.15224	.2947E 00	.7948E 06	.3778E 03									
T4C5	.050000	.001478	.070896	4	6.3256	.15914	.2859E 00	.8216E 06	.3931E 03									
T4C6	.050000	.001647	.077369	6	6.5119	.16561	.1229E 00	.8507E 06	.4102E 03									
T4C7	.050000	.001817	.083459	6	6.7102	.17170	.1187E 00	.8813E 06	.4288E 03									
T4C8	.050000	.002262	.097744	6	7.2782	.18598	.1075E 00	.9663E 06	.4842E 03									
T4C9	.050000	.002604	.107305	6	7.7547	.19554	.9929E-01	.1033E 07	.5325E 03									
T5C2	.060000	.000969	.046551	4	6.7324	.14479	.2893E 00	.7193E 06	.3411E 03									
T5C3	.060000	.001139	.053863	4	6.8677	.15210	.2828E 00	.7385E 06	.3516E 03									
T5C4	.060000	.001308	.060779	4	7.0187	.15902	.2755E 00	.7607E 06	.3640E 03									
T5C5	.060000	.001478	.067293	4	7.1837	.16553	.2674E 00	.7854E 06	.3782E 03									
T5C6	.060000	.001647	.073414	4	7.3612	.17165	.2590E 00	.8123E 06	.3940E 03									
T5C7	.060000	.001817	.079148	6	7.5497	.17739	.1113E 00	.8411E 06	.4114E 03									
T5C8	.060000	.002262	.092595	6	8.0889	.19083	.1011E 00	.9215E 06	.4631E 03									
T5C9	.060000	.002604	.101576	6	8.5406	.19982	.9366E-01	.9855E 06	.5082E 03									
T6C2	.080000	.000969	.043376	4	8.5052	.16162	.2631E 00	.6797E 06	.3258E 03									
T6C3	.080000	.001139	.050130	4	8.6325	.16837	.2572E 00	.6967E 06	.3353E 03									
T6C4	.080000	.001308	.056505	4	8.7741	.17474	.2505E 00	.7164E 06	.3464E 03									
T6C5	.080000	.001478	.062495	4	8.9285	.18073	.2433E 00	.7384E 06	.3591E 03									
T6C6	.080000	.001647	.068110	4	9.0941	.18635	.2358E 00	.7622E 06	.3731E 03									
T6C7	.080000	.001817	.073367	4	9.2698	.19161	.2280E 00	.7877E 06	.3885E 03									
T6C8	.080000	.002262	.085599	6	9.7700	.20384	.9234E-01	.8599E 06	.4347E 03									
T6C9	.080000	.002604	.093725	6	10.1875	.21196	.8571E-01	.9182E 06	.4749E 03									
T7C2	.100000	.000969	.041342	2	10.2869	.17958	.9872E 00	.6547E 06	.3163E 03									
T7C3	.100000	.001139	.047720	4	10.4093	.18596	.2411E 00	.6705E 06	.3252E 03									
T7C4	.100000	.001308	.053730	4	10.5452	.19197	.2347E 00	.6886E 06	.3355E 03									
T7C5	.100000	.001478	.059367	4	10.6929	.19761	.2278E 00	.7087E 06	.3472E 03									
T7C6	.100000	.001647	.064637	4	10.8511	.20288	.2207E 00	.7305E 06	.3602E 03									
T7C7	.100000	.001817	.069559	4	11.0185	.20780	.2135E 00	.7537E 06	.3743E 03									

T7C8 .100000 .002262 .080958 6 11.4937 .21920 .8645F-01 .8196F 06 .4165E 01
T7C9 .100000 .002604 .088481 6 11.8885 .22672 .8028F-01 .8731F 06 .4533E 01

CERAMIC AREA (C2 THRU C9)\$

TAIL LENGTH\$

TOTAL CERAMIC LENGTH FOR MIN 'ZEOC'\$

TOTAL MASS (LBS.) \$

TOTAL LENGTH\$

REACTOR \$

PEAK GAMMA IC \$

MIN 'ZEOC' \$

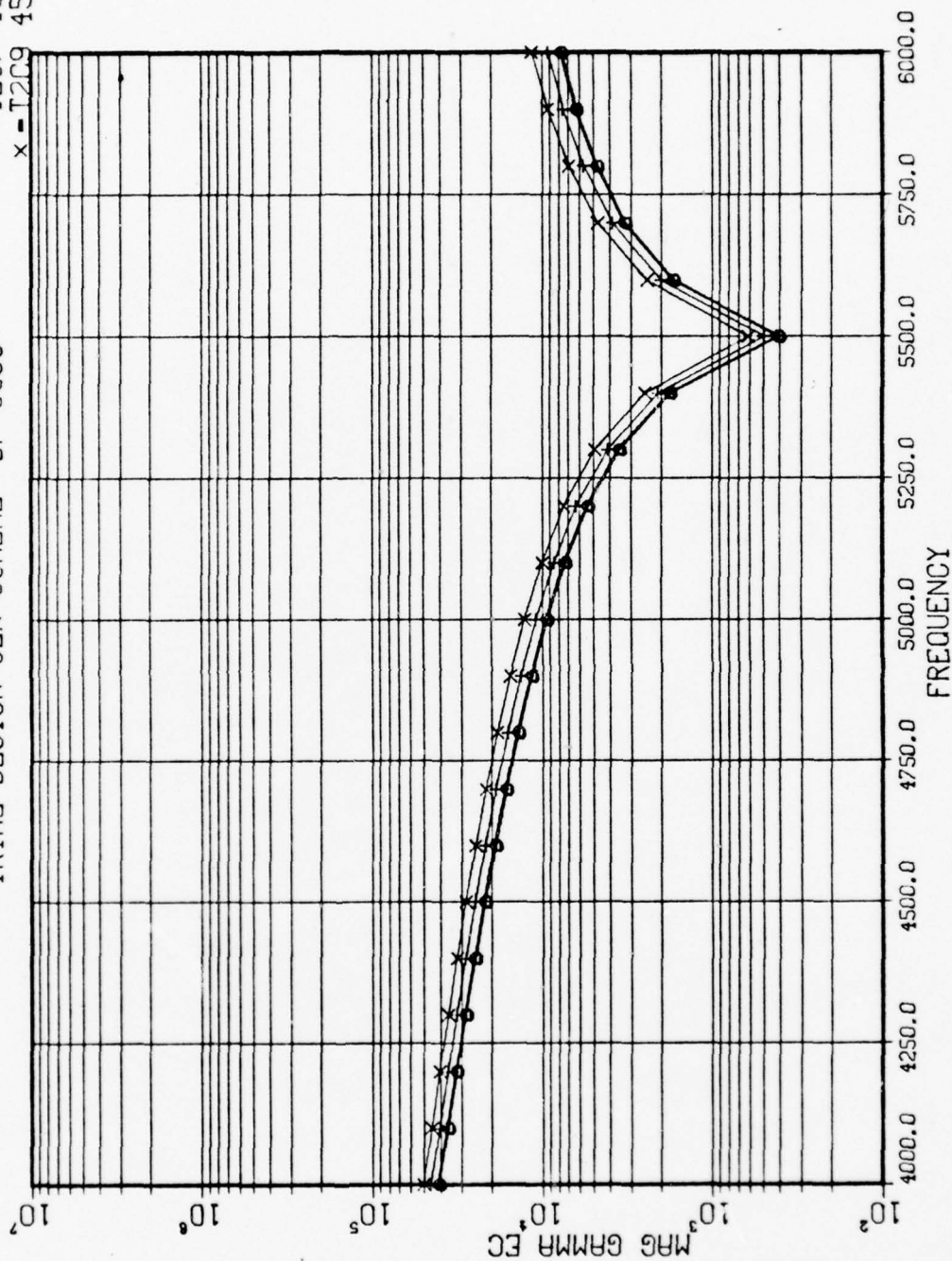
END

SECTION 3.3

PLT FAM additional sample (linear-log)

SEADUCER RUN 80123 MAY 10, 1971
 IP 2.3 WITH LOSSLESS HEAD, ARRAY 44
 TRIAL DESIGN GEN SCHEME DF-5500

LEGEND
 o - T202 45-55
 Δ - T203 45-55
 + - T207 45-55
 x - T209 45-55



SECTION 4.

PLT SRF

PLT SRF is designed for 3 dimensional plotting with the following features:

- 1) Option to plot a surface (hidden lines are suppressed), or families of curves in 3-D, or both.
- 2) Option for user selected Z axis scales or automatic Z axis self scaling via DISSPLA.
- 3) User supplied headings as well as X, Y and Z axis labels.

The data storage scheme for X, Y, and Z is illustrated in Fig. 4.1. LPTS, MEMBER, and NFAMILY are defined as before where now each member corresponds to a separate value along the Y axis. Array sizes required are explained within the PLT SRF subroutine.

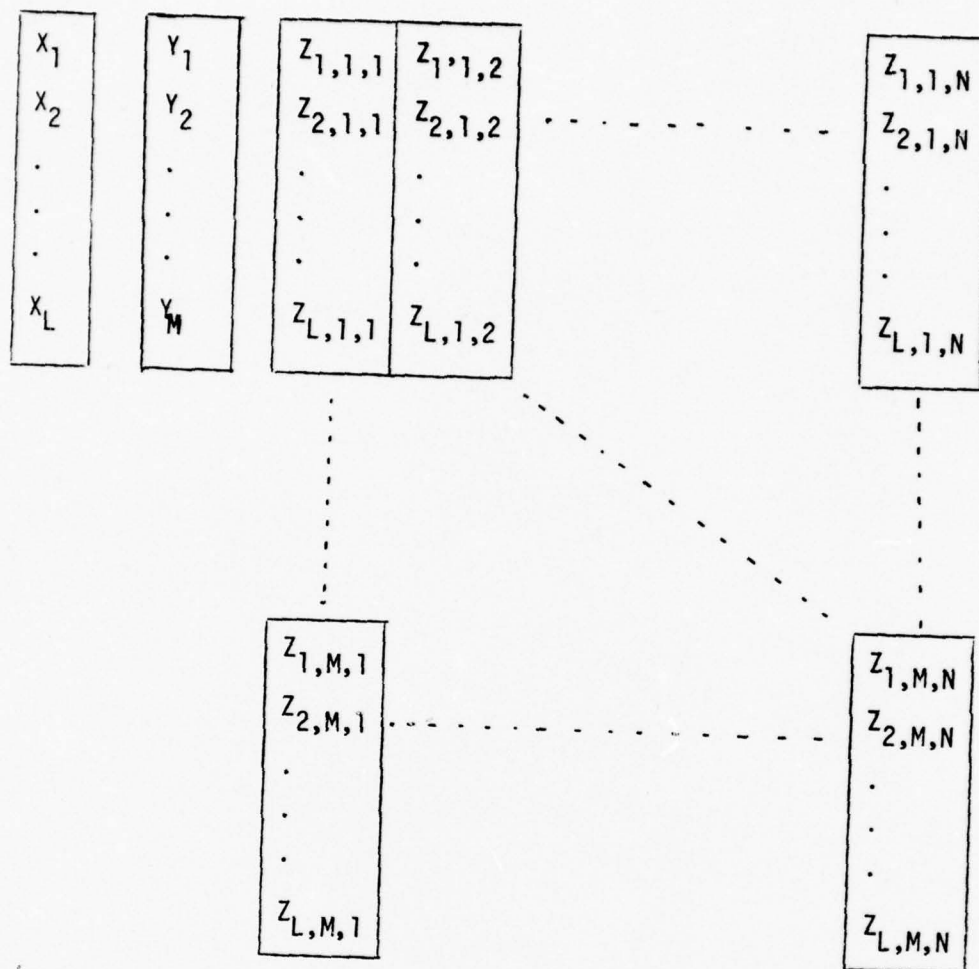
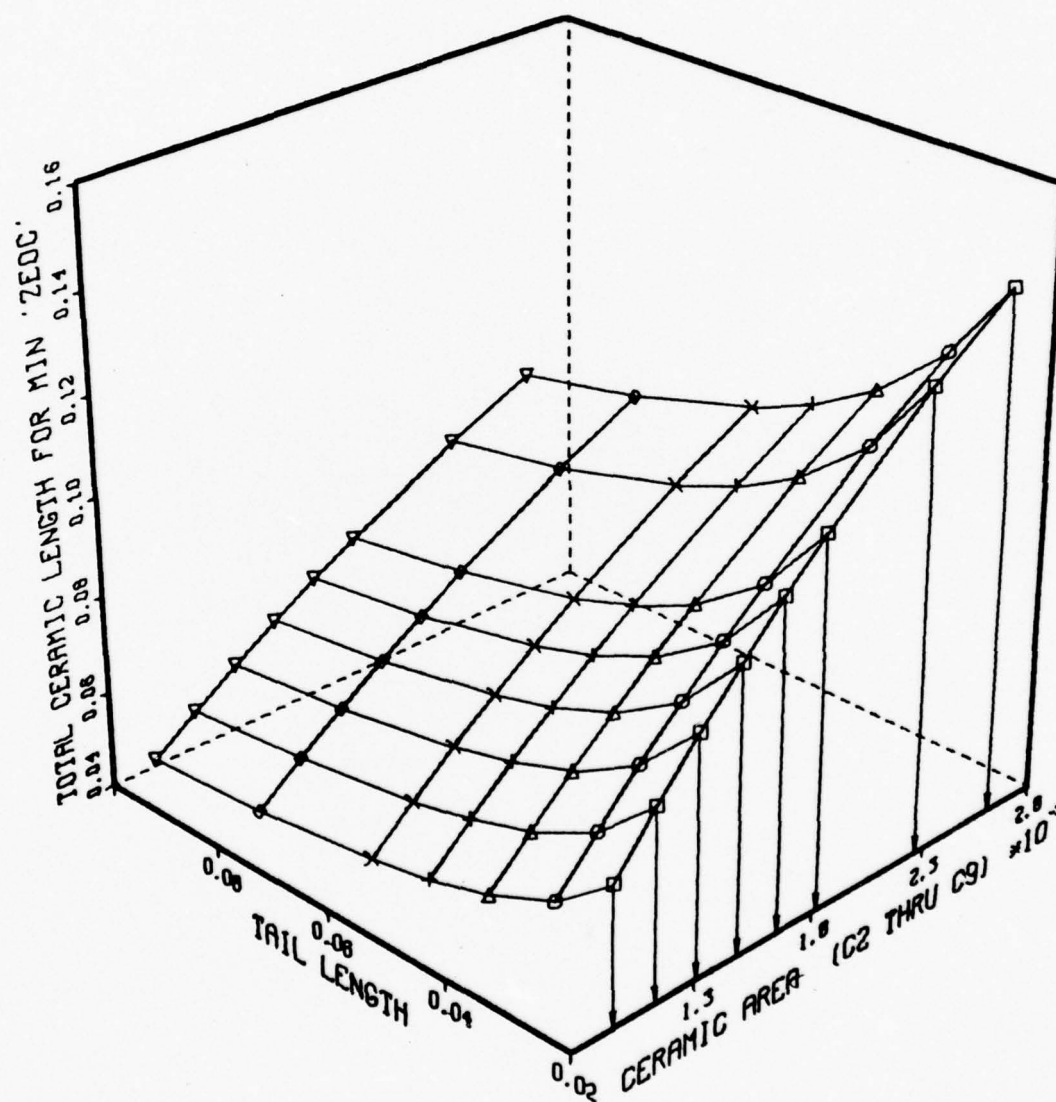


FIG. 4.1 PLT SRF data storage scheme for $X(L)$, $Y(M)$, and $Z(L,M,N)$
 (where $L = \text{LPTS}$, $M = \text{MEMBER}$, $N = \text{NFAMILY}$)

SECTION 4.1

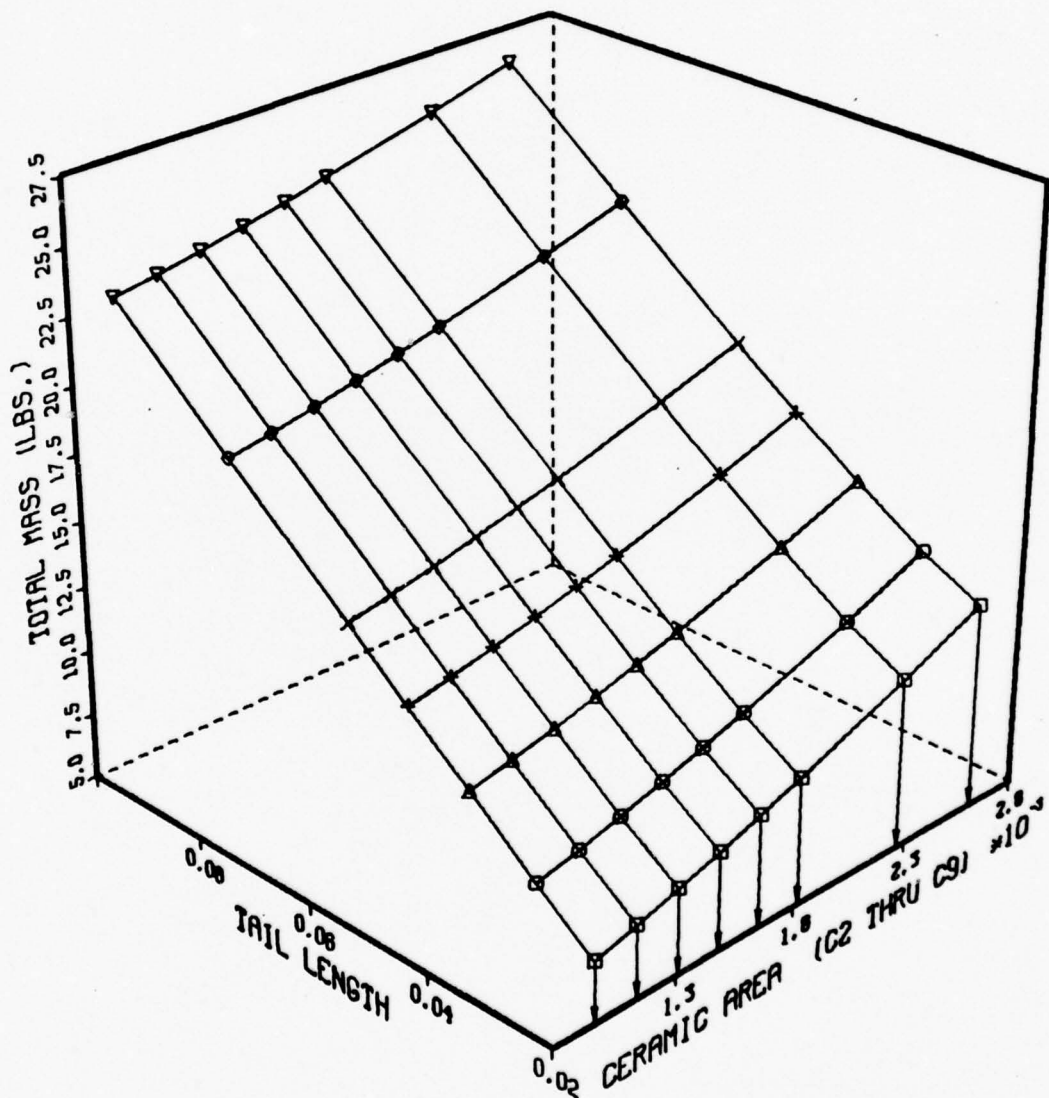
PLT SRF plotting samples

SEADUCER RUN 80122 MAY 6, 1971
 IP 2.3 DESIGN RUN WITH LOSSLESS HEAD
 TRIAL DESIGN GENERATING SCHEME FO-5500



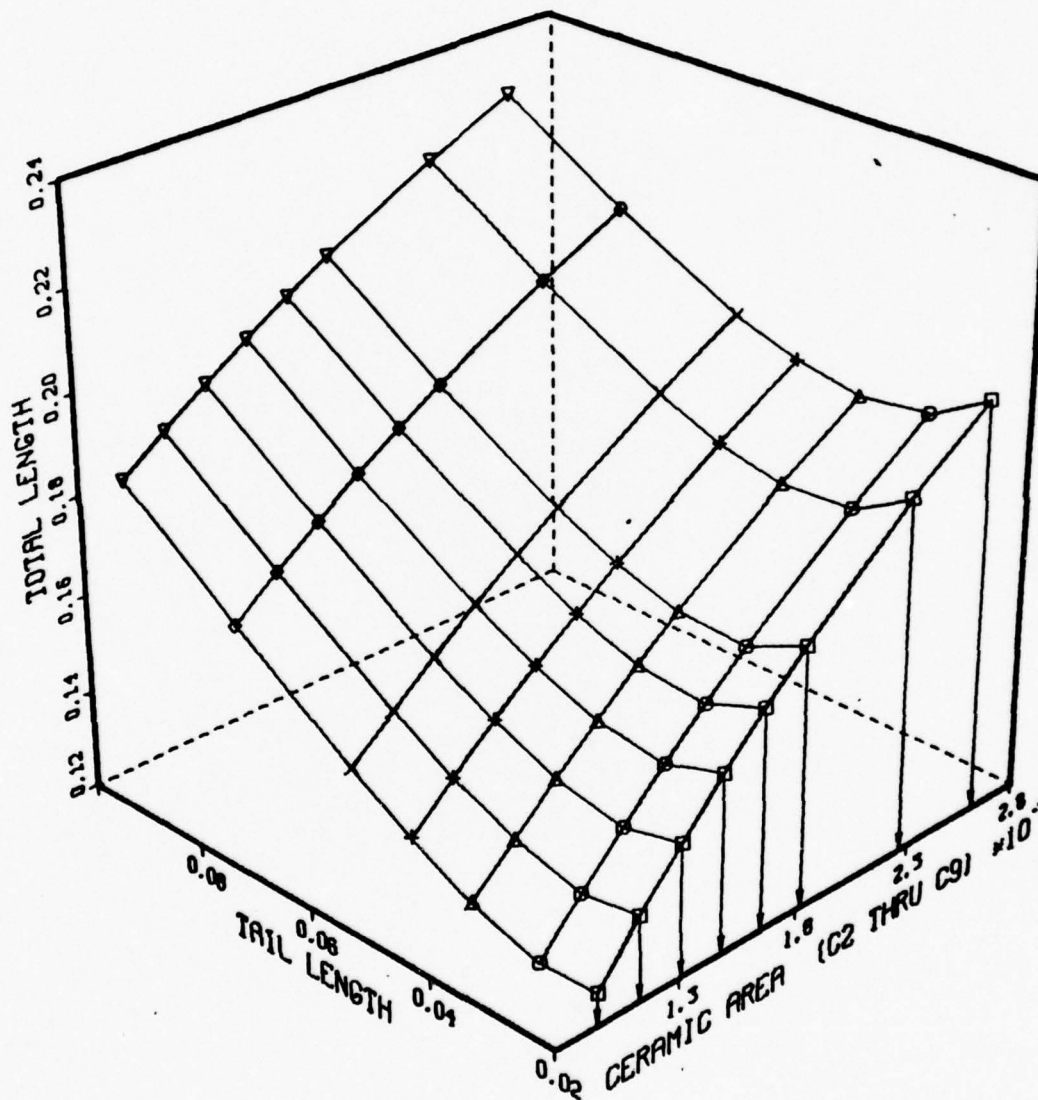
TIME RUN 2238 PLOT NO 1 DATE 06/30/71 N.U.C. DISPLAY VERSION 1

SEADUCER RUN 80122 MAY 6, 1971
 IP 2.3 DESIGN RUN WITH LOSSLESS HEAD
 TRIAL DESIGN GENERATING SCHEME FO-5500



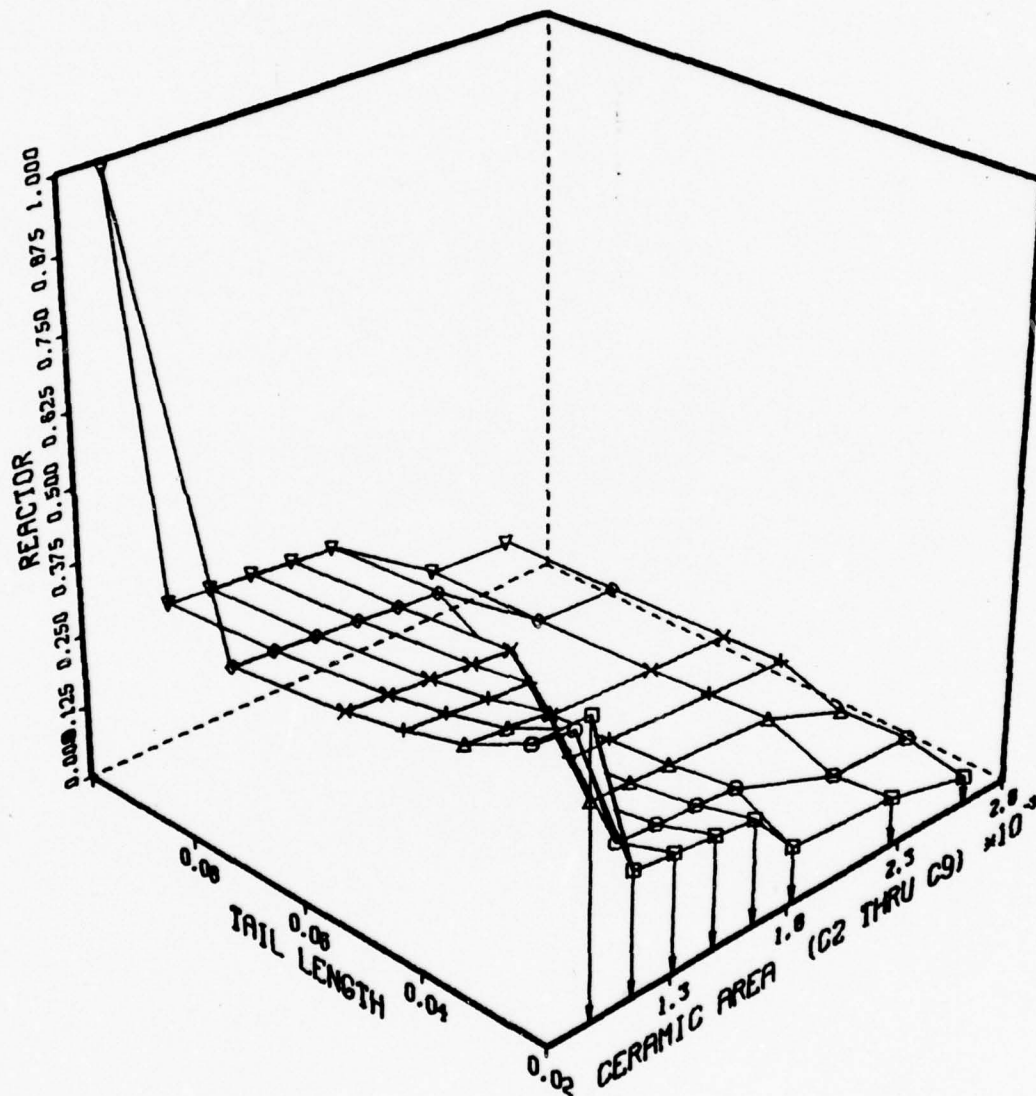
TIME RUN 2238 PLOT NO 2 DATE 06/30/71 N.U.C. DISPLAY VERSION 1

SEADUCER RUN 80122 MAY 6, 1971
 IP 2.3 DESIGN RUN WITH LOSSLESS HEAD
 TRIAL DESIGN GENERATING SCHEME FO-5500



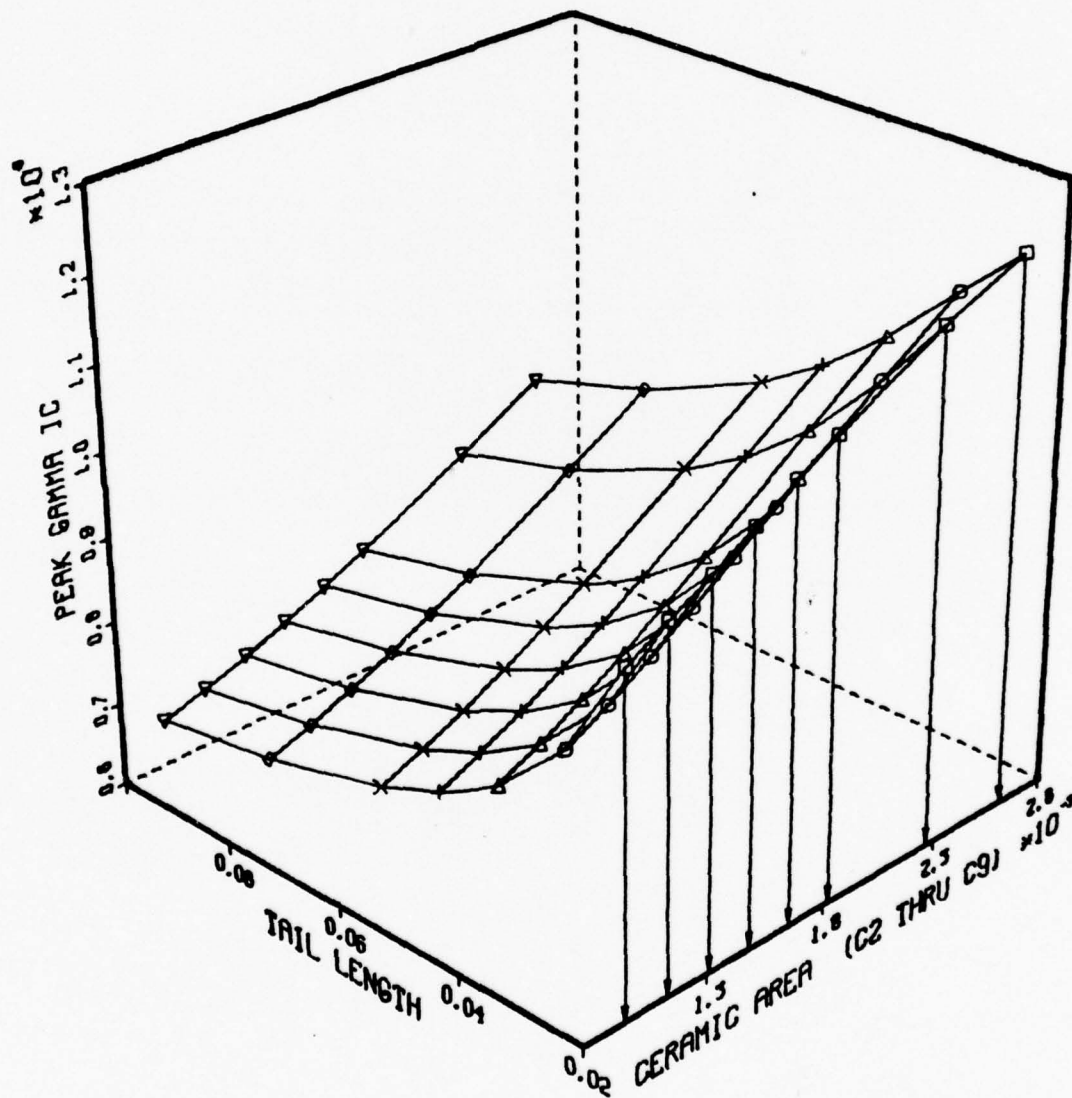
TIME RUN 2238 PLOT NO. 3 DATE 06/30/71 N.U.C. DISPLAY VERSION 1

SEADUCER RUN 80122 MAY 6, 1971
 IP 2.3 DESIGN RUN WITH LOSSLESS HEAD
 TRIAL DESIGN GENERATING SCHEME FO-5500



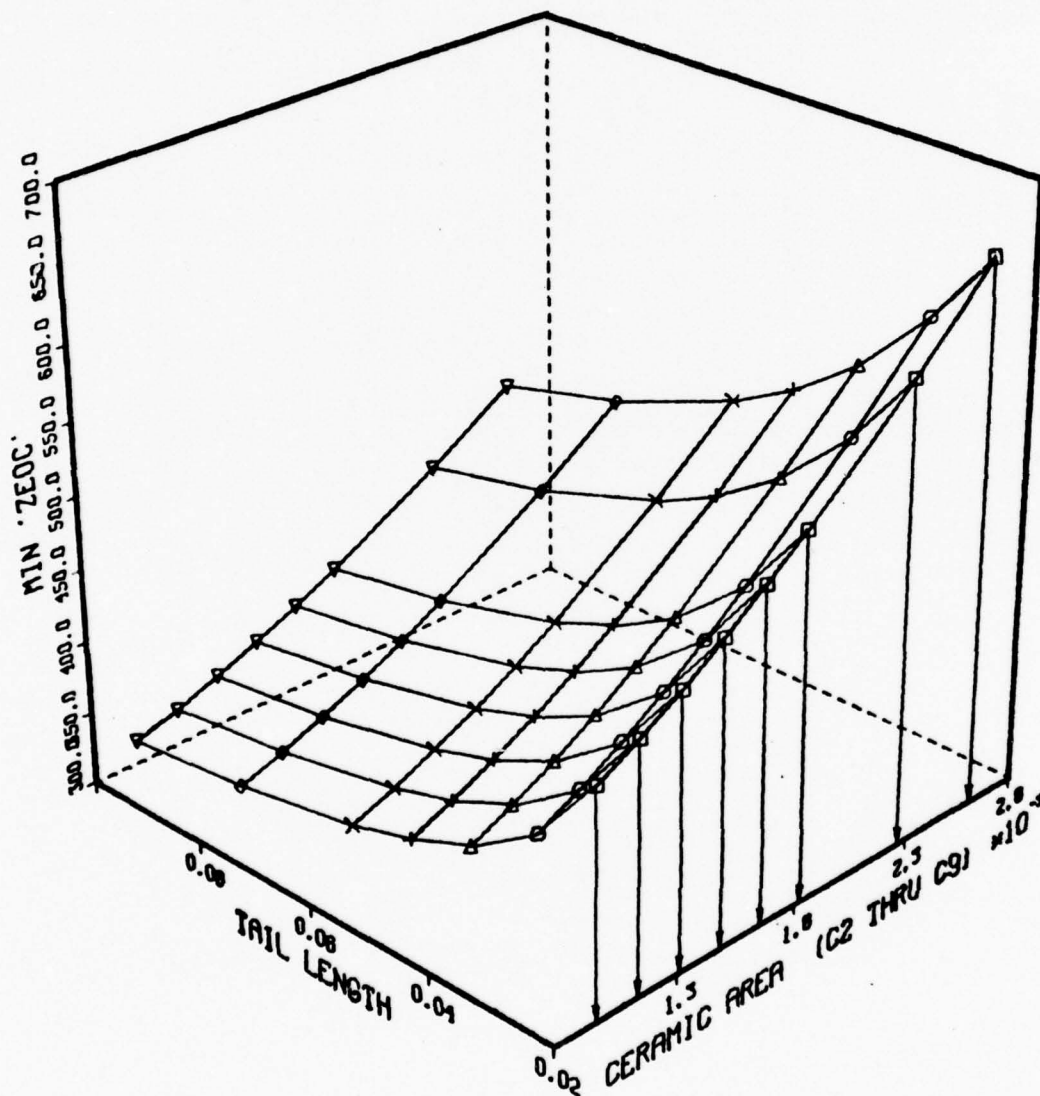
LINE RUN 2238 PLOT NO 4 DATE 06/30/71 M.U.C. DISPLAY VERSION 1

SEADUCER RUN 80122 MAY 6, 1971
 IP 2.3 DESIGN RUN WITH LOSSLESS HEAD
 TRIAL DESIGN GENERATING SCHEME FO-5500



TIME RUN 2238 PLOT NO 5 DATE 06/30/71 N.U.C. DISPLAY VERSION 1

SEADUCER RUN 80122 MAY 6, 1971
 IP 2.3 DESIGN RUN WITH LOSSLESS HEAD
 TRIAL DESIGN GENERATING SCHEME FO-5500



SECTION 4.2

PLT SRF program listing

QRUN, /RN PLTSRF, ~~1000050~~ 10000, LM6010x14522, 2, 50

MCCLFARY, 60, 6331

QASG, M 8, T, PLOT
QASG, T B., T, 2004
QREWIND B.
QCOPIB B., TPF\$.
QFREE B.

QFOR, IS CONTRL, CONTRL

C * * * * * PLY SRF CONTROL ROUTINE * * * * * * * * *

```
COMMON X3D( 8), Y3D( 7), Z3D( 8, 7, 6), ZMAT( 56), WORK3D( 34),
1      IHDLP(6), IHDMEM(6), IHDFAM(12, 6), IHEAD(12, 3),
2      I BUF(2000)                                SET
COMMON / NUMS / LPTS, MEMBER, NFAMLY, NHLINS
DIMENSION I CHK(16)
DATA N WRD P C /14/                                @ WORDS PER CARD IMAGE ON UNIVAC 1108
DATA IDOLAR/6H $/                                  1108
DATA IN UNIT / 5 /
```

C***** USER SETS NHLINS = NUMBER OF HEADING LINES TO BE LOADED
NHLINS = 3

C***** LOAD IHEAD FOR PLOT HEADINGS

```
DO 4100 J = 1, NHLINS
READ( IN UNIT, 200 ) (IHEAD(I, J), I=1, 12)
FLD(30, 6, I HEAD(12, J) ) = I DOLAR                                1108
PRINT 201, (IHEAD(I, J), I=1, 12)
```

4100 CONTINUE

C***** READ AND PRINT ANY EXTRA INFORMATION IF DESIRED

```
READ( IN UNIT, 200 ) (I CHK(I), I=1, N WRD P C)
PRINT 201, (I CHK(I), I=1, N WRD P C)
READ( IN UNIT, 200 ) (I CHK(I), I=1, N WRD P C)
PRINT 201, (I CHK(I), I=1, N WRD P C)
200 FORMAT(13A6, A2)                                1108
201 FORMAT(1X, 13A6, A2)                                1108
```

C***** USER LOADS INPUT DATA FOR LPTS, MEMBER, NFAMLY, X, Y, DTA LBL

```
POUNDS = 2.20462
LPTS = 8
MEMBER = 7
NFAMLY = 6
DO 9 M = 1, MEMBER
DO 8 L = 1, LPTS
READ(5, 100) Y3D(M), X3D(L), (Z3D(L, M, N), N=1, NFAMLY)
PRINT 101, Y3D(M), X3D(L), (Z3D(L, M, N), N=1, NFAMLY)
100 FORMAT( 3X, 4X, 3F8.6, 3X, F8.4, F8.5, 3E10.4)
101 FORMAT(1X, 3X, 4X, 3F8.6, 3X, F8.4, F8.5, 3E10.4)
DO 10 N = 1, NFAMLY
IF (N.EQ.2) Z3D(L, M, N) = Z3D(L, M, N) * POUNDS
10 CONTINUE
8 CONTINUE
9 CONTINUE
```

C***** LOAD IHD LPT FOR X AXIS TITLE

```
READ( IN UNIT, 200 ) (IHD LPT(I), I=1, 6)
FLD(30, 6, IHD LPT(6) ) = I DOLAR                                1108
PRINT 201, (IHD LPT(I), I=1, 6)
```

C***** LOAD IHD MEM FOR Y AXIS TITLE

```
READ( IN UNIT, 200 ) (IHD MEM(I), I=1, 6)
FLD(30, 6, IHD MEM(6) ) = I DOLAR                                1108
PRINT 201, (IHD MEM(I), I=1, 6)
```

C***** LOAD IHD FAM FOR INDIVIDUAL PLOTS (Z AXIS)

DO 4000 N = 1, NFAMLY

```
READ( IN UNIT, 200 ) (IHD FAM(I,N), I=1,12)  
FLD(30, 6, IHD FAM(12,N) ) = I DOLAR  
PRINT      201 , (IHD FAM(I,N), I=1,12)
```

1108

4000 CONTINUE

```
C * * * * * INPUT IS NOW LOADED * * * * *  
CALL PLT SRF
```

```
C * * * * * TERMINATE ENTIRE PLOT RUN * * * * *  
CALL PLOT(0., 0., 999)  
STOP  
END
```

```

@FOR,IS      PLTSRF,PLTSRF
      SUBROUTINE PLT SRF
C * * * * * PLT SRF (USING DISSPLA PACKAGE) * * * * *
C * * * * * GENERAL PROGRAM TO PLOT 3D FAMILIES OF CURVES AND/OR SURFACES * *
C * * * * * PROGRAMMED BY L. E. MCCLEARY  NUC CODE 601 * * * * *

C * * * * * DIMENSION AS FOLLOWS * * * * *
C * * * * * WHERE L=LPTS, M=MEMBER, N=NFAMILY, H=NHLINS
C * * * * * LOAD COMMONS / /, /NUMS/ FROM CONTROL
C      COMMON X3D(L), Y3D(M), Z3D(L,M,N), ZMAT(L,M), WORK3D(2*L+2*M+4),
C      1      IHDLP(6), IHDMEM(6), IHDFAM(12, N), IHEAD(12,H),
C      2      I BUF(200) SET
C      COMMON / NUMS / LPTS, MEMBER, NFAMILY, NHLINS
C      COMMON / NOLOAD / ZMIN(N), ZMAX(N), ZPLOT(L), YPLOT(L)

      COMMON X3D( 8),Y3D( 7),Z3D( 8, 7, 6),ZMAT( 56),WORK3D( 34),
      1      IHDLP(6), IHDMEM(6), IHDFAM(12, 6), IHEAD(12,3),
      2      I BUF(2000) SET
      COMMON / NUMS / LPTS, MEMBER, NFAMILY, NHLINS
      COMMON / NOLOAD / ZMIN(6), ZMAX(6), ZPLOT( 8), YPLOT( 8)

      COMMON / CM VF3D / XORIG,XTOP, YORIG,YTOP, ZORIG,ZTOP,
      1      XVU,YVU,ZVU, XABS,YABS,ZABS

      DIMENSION Z ORIG L( 6), ZDELTL( 6), ZTOPL( 6)
      DATA NBUF / 2000/ SET
      DATA IFTF/0/
      DATA I PLT UN / 8 / SET

      DATA(ZORIGL(L),L=1,6)/.04, 5., .14, 0., .6E6, 300./
      DATA(ZDELTL(L),L=1,6)/.04, 5., .04, .2, .2E6, 100./
      DATA(ZTOP L(L),L=1,6)/.20, 30., .26, .8, 1.4E6, 800./

      PRINT 1
      1 FORMAT(1H1)

C * * * * * INITIALIZE PLOT BUFFER
      IF(IFTF .EQ. 0) CALL PLOTS(IRUF,NBUF, I PLT UN)
      IFTF=1

C * * * * * FIND MAX MIN OVER ALL MEMBERS FOR EACH FAMILY
      DO 500 N = 1, NFAMILY
      Z MIN(N) = 1.E30
      Z MAX(N) = -1.E30
      500 CONTINUE
      DO 3000 L = 1, LPTS
      DO 2000 M = 1, MEMBER
      DO 1000 N = 1,NFAMILY
      IF ( Z3D(L,M,N) .LT. Z MIN(N) ) Z MIN(N) = Z3D(L,M,N)
      IF ( Z3D(L,M,N) .GT. Z MAX(N) ) Z MAX(N) = Z3D(L,M,N)
      1000 CONTINUE
      2000 CONTINUE
      3000 CONTINUE

C * * * * * USE DISSPLA PACKAGE * * * * *

      DO 5000 N = 1, NFAMILY
C***** SET N SELF Z = 0 FOR USER SUPPLIED SCALES ON Z
C***** SET N SELF Z = 1 FOR SELF SCALING ON Z
      N SELF Z = 0
      N SELF Z = 1

```

```

      IF ( N SELF Z .EQ. 0 ) GO TO 20
C * * * * * FIND Z SCALES (OPTION)
      CALL AXSPLT( Z MIN(N), Z MAX(N), 0., Z ORIG, Z DELT, Z SCALE )
      Z TOP = Z ORIG + Z DELT * Z SCALE
      GO TO 30

20 CONTINUE
C***** USER SETS Z SCALES (OPTION)
      Z ORIG = ZORIGL(N)
      Z DELT = ZDELTL(N)
      Z TOP = ZTOPL(N)
30 CONTINUE
C***** USER SETS X SCALES
      X ORIG = .0008
      X DELT = .0005
      X TOP = .0028
C***** USER SETS Y SCALES
      Y ORIG = .02
      Y DELT = .02
      Y TOP = .10

      NTH PLT = N
      CALL BGNPL( -NTH PLT )
      CALL TITL3D( 1H , 1, 7.0, 7.0 )
      DO 4500 J = 1, NHLINS
      CALL HEADIN( IHEAD(1,J), 100, 2, NHLINS)
4500 CONTINUE
      XABS = 1.
      YABS = 1.
      ZABS = 1.
      CALL AXES3D( IHD LPT, 100, IHD MEM, 100, IHD FAM(1,N), 100,
A      XABS, YABS, ZABS)
      X VU = -3.
      Y VU = -3.
      Z VU = 3.
      CALL VUABS(XVU, YVU, ZVU)
      CALL GRAF3D(XORIG,XDELT,XTOP, YORIG,YDELT,YTOP, ZORIG,ZDELT,ZTOP)

      DO 4900 M = 1, MEMBER
      DO 4800 L = 1, LPTS
      Y PLOT(L) = Y3D(M)
      ZPLOT(L) = Z3D(L,M,N)
      IF ( M .NE. 1 ) GO TO 4800
C * * * * * ARROW PROJECTIONS FROM CURVE TO AXIS
      CALL RELPT3(X3D(L), YPLOT(L), ZPLOT(L), XFROM, YFROM)
      CALL RELPT3(X3D(L), YPLOT(L), ZORIG, X TO, Y TO)
      CALL QARROW(XFROM, YFROM, X TO, Y TO)
4800 CONTINUE
C***** USER SETS N CURV = 0 FOR NOT PLOTTING CURVES OF CONSTANT Y
C***** USER SETS N CURV = 1 FOR PLOTTING CURVES OF CONSTANT Y
      N CURV = 0
      N CURV = 1
      IF ( N CURV .EQ. 0 ) GO TO 4820
      I MARK = 1
      CALL CURV3D( X3D, YPLOT, ZPLOT, LPTS, I MARK)
4820 CONTINUE
4900 CONTINUE

      CALL VUFR3D

      CALL SURTRN('BOTH')

```

```

CALL SURSZ( X3D(1), X3D(LPTS), Y3D(1), Y3D(MEMBER) )

LM = 1
DO 4986 M = 1, MEMBER
DO 4985 L = 1, LPTS
Z MAT(LM) = Z3D(L,M,N)
LM = LM + 1
4985 CONTINUE
4986 CONTINUE
IXPTS=1
IYPTS=1
CALL SURMAT(Z MAT, IXPTS, LPTS, IYPTS, MEMBER, WORK3D)

CALL ENDPL( -NTH PLT )
PRINT 4990, NTH PLT, (IHD FAM(I,N), I=1,12),
P XORIG,XDELT,XTOP, YORIG,YDELT,YTOP, ZORIG,ZDELT,ZTOP
4990 FORMAT(/' COMPLETED PLOT NO.', I3, ' *** ', 12A6 /
F ' X', 3E10.4, ' Y', 3E10.4, ' Z', 3E10.4 / )
5000 CONTINUE
6000 CONTINUE

RETURN
END

```

1108

```

QFOR,IS      X3DMAT,X3DMAT
  FUNCTION X3DMAT(IX ROW)
  COMMON  X3D( 8),Y3D( 7),Z3D( 8, 7, 6),ZMAT( 56),WORK3D( 34),
1          IHDLP(6), IHDMM(6), IHDFF(12, 6), IHEAD(12,3),
2          I BUF(200)
  X3DMAT = X3D(IX ROW)
  RETURN
  END
QFOR,IS      Y3DMAT,Y3DMAT
  FUNCTION Y3DMAT(IY COL)
  COMMON  X3D( 8),Y3D( 7),Z3D( 8, 7, 6),ZMAT( 56),WORK3D( 34),
1          IHDLP(6), IHDMM(6), IHDFF(12, 6), IHEAD(12,3),
2          I BUF(200)
  Y3DMAT = Y3D(IY COL)
  RETURN
  END

```

```

@FOR,IS      VUER3D,VUER3D
SUBROUTINE VUER3D
COMMON / CM VF3D / XORIG,XTOP, YORIG,YTOP, ZORIG,ZTOP,
1           XVU,YVU,ZVU, XABS,YABS,ZABS
DIMENSION XOT(2), YOT(2), ZOT(2), XB(2), YB(2), ZB(2), PDEL(3)
DIMENSION IXOTC(7,4), IYOTC(7,4), IZOTC(7,4), IBXYZC(6,4)
DATA (BDEL(L),L=1,3) / -.003, 0., .003 /
DATA ((IXOTC(I,N),I=1,7),N=1,4) /
X 1,1,2,2,2,1,2, 1,2,2,2,1,1,1, 2,2,1,1,1,2,1, 2,1,1,1,2,2,2/
DATA ((IYOTC(I,N),I=1,7),N=1,4) /
Y 2,1,1,1,2,2,2, 1,1,2,2,2,1,2, 1,2,2,2,1,1,1, 2,2,1,1,1,2,1/
DATA (IZOTC(I),I=1,7) /
Z 1,1,1,2,2,2,1/
DATA((IBXYZC(I,N),I=1,6),N=1,4) /
R 1,2,2,3,3,1, 2,1,1,3,3,2, 1,2,2,3,3,1, 2,1,1,3,3,2/

IF ( ZVU .LT. 0. ) RETURN
N CORNR = 0
IF ( XVU .LE. 0. .AND. YVU .LE. 0. ) N CORNR = 1
IF ( XVU .GE. XABS .AND. YVU .LE. 0. ) N CORNR = 2
IF ( XVU .GE. XABS .AND. YVU .GE. YABS ) N CORNR = 3
IF ( XVU .LE. 0. .AND. YVU .GE. YABS ) N CORNR = 4
IF ( N CORNR .EQ. 0 ) RETURN

XOT(1) = XORIG
XOT(2) = XTOP
YOT(1) = YORIG
YOT(2) = YTOP
ZOT(1) = ZORIG
ZOT(2) = ZTOP

DO 260 I DEL = 1,3
DO 250 I = 1,6
IC = IXOTC( I,NCORNR)
XB(1) = XOT(IC)
IC = IYOTC( I,NCORNR)
YB(1) = YOT(IC)
IC = IZOTC( I)
ZB(1) = ZOT(IC)
IF ( I .EQ. 6 ) GO TO 205
IC = IXOTC(I+1,NCORNR)
XB(2) = XOT(IC)
IC = IYOTC(I+1,NCORNR)
YB(2) = YOT(IC)
IC = IZOTC(I+1)
ZB(2) = ZOT(IC)
GO TO 210
205 CONTINUE
IC = IXOTC( 1,NCORNR)
XB(2) = XOT(IC)
IC = IYOTC( 1,NCORNR)
YB(2) = YOT(IC)
IC = IZOTC( 1)
ZB(2) = ZOT(IC)
210 CONTINUE
L WIDE = IBXYZC(I, NCORNR)
GO TO (211,212,213), L WIDE
211 XB(1) = XB(1) + R DEL(I DEL) * (XTOP-XORIG)
XB(2) = XB(1)
GO TO 215
212 YB(1) = YB(1) + R DEL(I DEL) * (YTOP-YORIG)

```

```

        YB(2) = YB(1)
        GO TO 215
213  ZB(1) = ZB(1) + R DEL(I DEL) * (ZTOP-ZORI6)
        ZB(2) = ZB(1)
215  CONTINUE
        CALL CURV3D(XB, YB, ZB, 2, 0)
250  CONTINUE
260  CONTINUE

```

```

        CALL DASH
        IC = IXOTC( 7, NCORNR)
        XR(1) = XOT(IC)
        IC = IYOTC( 7, NCORNR)
        YR(1) = YOT(IC)
        IC = IZOTC( 7)
        ZR(1) = ZOT(IC)
        DO 300 I = 1, 5, 2
        IC = IXOTC( I, NCORNR)
        XB(2) = XOT(IC)
        IC = IYOTC( I, NCORNR)
        YB(2) = YOT(IC)
        IC = IZOTC( I)
        ZB(2) = ZOT(IC)
        CALL CURV3D(XB, YB, ZB, 2, 0)
300  CONTINUE
        CALL RESET('DASH')
        RETURN
        END

```

QTOP
QPRFP
QPRF,T TPF\$.
QMAP,XI SYMRUN,ABSRUN
IN CONTRL
QXQT ABSRUN

SEADUCER RUN 80122 MAY 6,1971\$ LIKE 80089 0=50
IP 2.3 DESIGN RUN WITH LOSSLESS HEAD\$
TRIAL DESIGN GENERATING SCHEME F0=5500 \$
CHARGE TO 16000501 ARRAY DESIGN

	L T2L1	A C3D	T L C3D	NP	T	MASS	T	LENGTH	REACTOR	GAMMA	IC	GAM	FC	MIN
T1C2	.020000	.000969	.068308	4	3.3061	.12655	.4923F	00	.9984F	06	.4536E	03		
T1C3	.020000	.001139	.078810	6	3.4973	.13705	.2095F	00	.1024F	07	.4686F	03		
T1C4	.020000	.001308	.088665	6	3.7102	.14690	.1997F	00	.1051F	07	.4857E	03		
T1C5	.020000	.001478	.097868	6	3.9421	.15611	.1897F	00	.1080E	07	.5048E	03		
T1C6	.020000	.001647	.106433	6	4.1905	.16467	.1798F	00	.1108E	07	.5255E	03		
T1C7	.020000	.001817	.114374	8	4.4531	.17261	.9567E-01		.1136E	07	.5478E	03		
T1C8	.020000	.002262	.132576	8	5.1965	.19082	.8253E-01		.1201E	07	.6113E	03		
T1C9	.020000	.002604	.144293	10	5.8091	.20253	.4718E-01		.1241E	07	.6644E	03		
T2C2	.029200	.000969	.058624	4	4.0579	.12606	.3969F	00	.8752F	06	.4028E	03		
T2C3	.029200	.001139	.067846	4	4.2249	.13529	.3853F	00	.9006F	06	.4169E	03		
T2C4	.029200	.001308	.076560	6	4.4116	.14400	.1654F	00	.9296F	06	.4334E	03		
T2C5	.029200	.001478	.084769	6	4.6160	.15221	.1592F	00	.9608E	06	.4519E	03		
T2C6	.029200	.001647	.092480	6	4.8360	.15992	.1528E	00	.9936F	06	.4723E	03		
T2C7	.029200	.001817	.099712	6	5.0700	.16715	.1464F	00	.1027E	07	.4943E	03		
T2C8	.029200	.002262	.116568	8	5.7386	.18401	.7299F-01		.1114F	07	.5586E	03		
T2C9	.029200	.002604	.127729	8	6.2971	.19517	.6631F-01		.1174F	07	.6129E	03		
T3C2	.040000	.000969	.052474	4	4.9809	.13071	.3405E	00	.7952E	06	.3708E	03		
T3C3	.040000	.001139	.060763	4	5.1318	.13900	.3321F	00	.8180E	06	.3833E	03		
T3C4	.040000	.001308	.068613	4	5.3006	.14685	.3227F	00	.8443F	06	.3980E	03		
T3C5	.040000	.001478	.076011	6	5.4853	.15425	.1388F	00	.8735F	06	.4148E	03		
T3C6	.040000	.001647	.082978	6	5.6844	.16122	.1340F	00	.9048F	06	.4334E	03		
T3C7	.040000	.001817	.089527	6	5.8963	.16777	.1291F	00	.9375E	06	.4536E	03		
T3C8	.040000	.002262	.104895	6	6.5037	.18314	.1162F	00	.1026E	07	.5134E	03		
T3C9	.040000	.002604	.115152	8	7.0129	.19339	.6003E-01		.1094F	07	.5651E	03		
T4C2	.050000	.000969	.048974	4	5.8525	.13721	.3098F	00	.7501E	06	.3530E	03		
T4C3	.050000	.001139	.056695	4	5.9941	.14493	.3028F	00	.7708E	06	.3644E	03		
T4C4	.050000	.001308	.064004	4	6.1524	.15224	.2947F	00	.7948E	06	.3778E	03		
T4C5	.050000	.001478	.070896	4	6.3256	.15914	.2859E	00	.8216E	06	.3931E	03		
T4C6	.050000	.001647	.077369	6	6.5119	.16561	.1229E	00	.8507E	06	.4102E	03		
T4C7	.050000	.001817	.083459	6	6.7102	.17170	.1187E	00	.8813E	06	.4288E	03		
T4C8	.050000	.002262	.097744	6	7.2782	.18598	.1075E	00	.9663E	06	.4842E	03		
T4C9	.050000	.002604	.107305	6	7.7547	.19554	.9929E-01		.1033E	07	.5325E	03		
T5C2	.060000	.000969	.046551	4	6.7324	.14479	.2893F	00	.7193F	06	.3411E	03		
T5C3	.060000	.001139	.053863	4	6.8677	.15210	.2828E	00	.7385E	06	.3516E	03		
T5C4	.060000	.001308	.060779	4	7.0187	.15902	.2755F	00	.7607E	06	.3640E	03		
T5C5	.060000	.001478	.067293	4	7.1837	.16553	.2674E	00	.7854E	06	.3782E	03		
T5C6	.060000	.001647	.073414	4	7.3612	.17165	.2590E	00	.8123E	06	.3940E	03		
T5C7	.060000	.001817	.079148	6	7.5497	.17739	.1113E	00	.8411E	06	.4114E	03		
T5C8	.060000	.002262	.092595	6	8.0889	.19083	.1011E	00	.9215E	06	.4631E	03		
T5C9	.060000	.002604	.101576	6	8.5406	.19982	.9366E-01		.9855E	06	.5082E	03		
T6C2	.080000	.000969	.043376	4	8.5052	.16162	.2631F	00	.6797E	06	.3258E	03		
T6C3	.080000	.001139	.050130	4	8.6325	.16837	.2572F	00	.6967E	06	.3353E	03		
T6C4	.080000	.001308	.056505	4	8.7741	.17474	.2505E	00	.7164E	06	.3464E	03		
T6C5	.080000	.001478	.062495	4	8.9285	.18073	.2433E	00	.7384E	06	.3591E	03		
T6C6	.080000	.001647	.068110	4	9.0941	.18635	.2358E	00	.7622E	06	.3731E	03		
T6C7	.080000	.001817	.073367	4	9.2698	.19161	.2280E	00	.7877E	06	.3885E	03		
T6C8	.080000	.002262	.085599	6	9.7700	.20384	.9234E-01		.8599E	06	.4347E	03		
T6C9	.080000	.002604	.093725	6	10.1875	.21196	.8571E-01		.9182E	06	.4749E	03		
T7C2	.100000	.000969	.041342	2	10.2869	.17958	.9872E	00	.6547E	06	.3163E	03		
T7C3	.100000	.001139	.047720	4	10.4093	.18596	.2411E	00	.6705E	06	.3252E	03		

T7C4	.100000	.001308	.053730	4	10.5452	.19197	.2347F 00	.6886F 06	.3355E 03
T7C5	.100000	.001478	.059367	4	10.6929	.19761	.2278E 00	.7087F 06	.3472F 03
T7C6	.100000	.001647	.064637	4	10.8511	.20288	.2207E 00	.7305E 06	.3602E 03
T7C7	.100000	.001817	.069559	4	11.0185	.20780	.2135F 00	.7537F 06	.3743E 03
T7C8	.100000	.002262	.080958	6	11.4937	.21920	.8645F-01	.8196E 06	.4165E 03
T7C9	.100000	.002604	.088481	6	11.8885	.22672	.8028F-01	.8731E 06	.4533E 03

CERAMIC AREA (C2 THRU C9)\$

TAIL LENGTH \$

TOTAL CERAMIC LENGTH FOR MIN 'ZEOC'\$

TOTAL MASS (LBS.) \$

TOTAL LENGTH\$

REACTOR \$

PEAK GAMMA IC \$

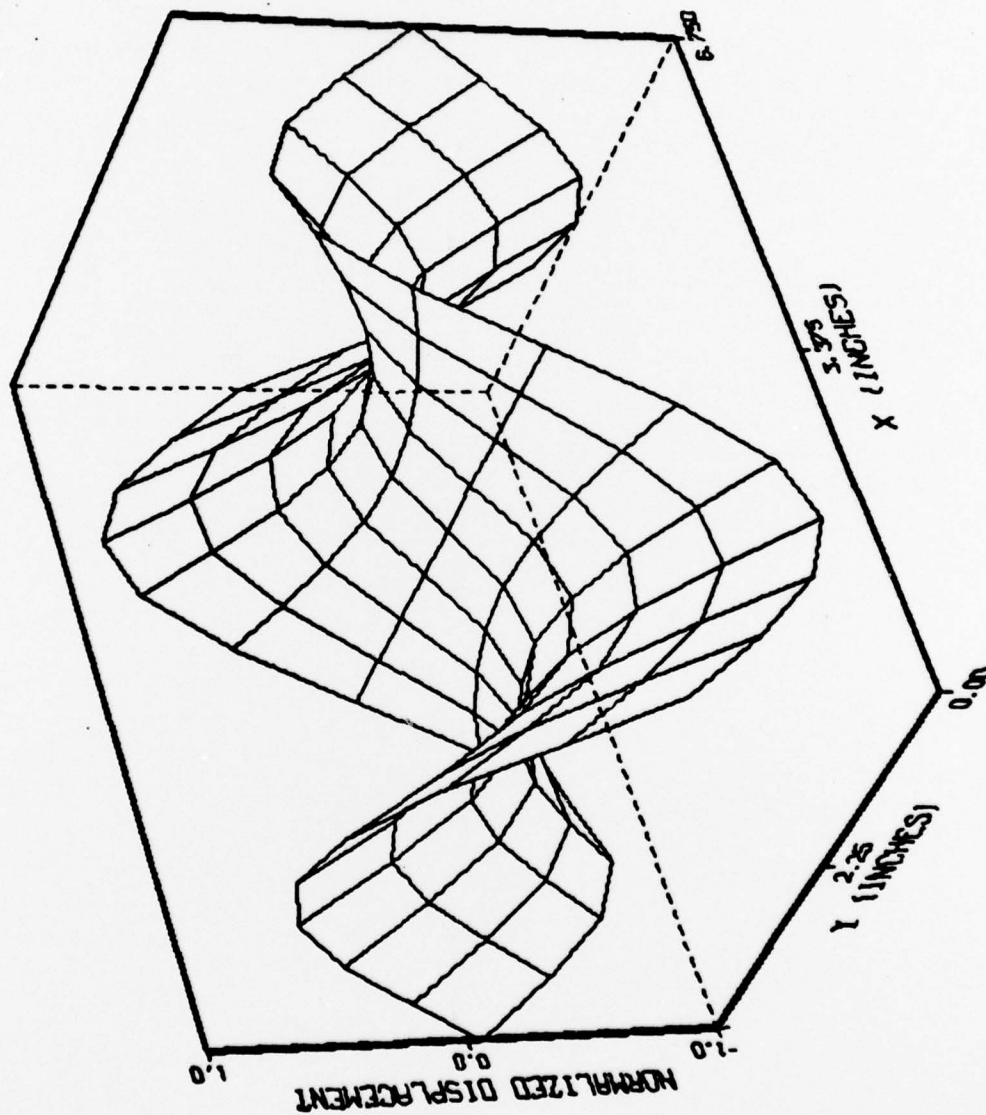
MIN 'ZEOC' \$

QFIN

SECTION 4.3

PLT SRF additional sample

BOS6 RECTANGULAR HEAD
 NORMALIZED MEASURED FREQUENCY - 2.41
 NORMALIZED THEORETICAL FREQUENCY - 2.44



SECTION 5.

PLT PTN

PLT PTN is a modified version of PLT FAM specifically oriented towards polar plot applications (such as beam patterns). Its features include:

- 1) Option for user selected axis scales or automatic self scaling via
DISSPLA
- 2) User supplied headings and legend labels.

The data storage scheme for angle vs. magnitude is the same as for Fig. 3.1 of PLT FAM where X corresponds to angle and Y corresponds to magnitude. Array sizes required are explained within the PLT PTN subroutine.

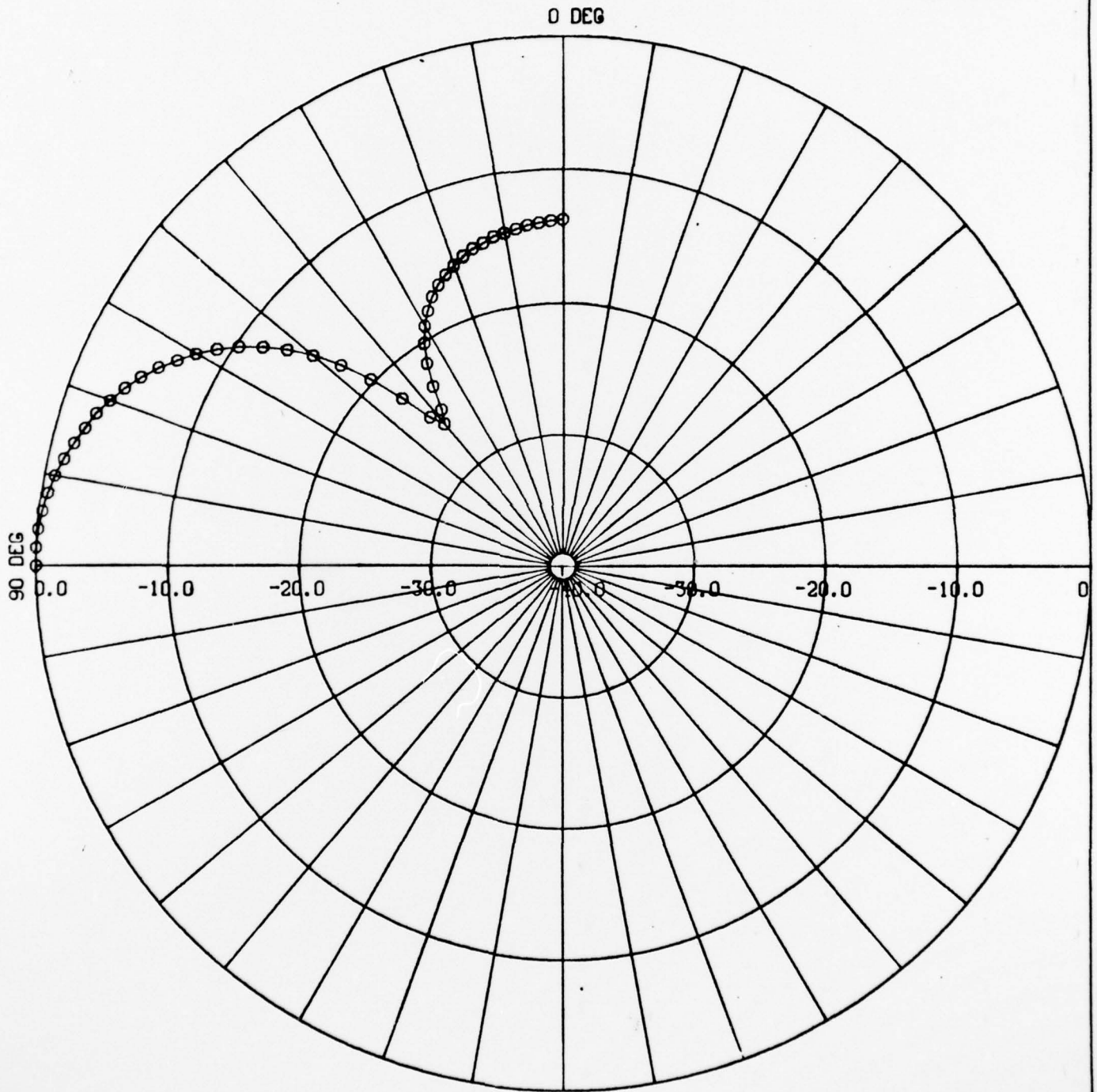
Notice that in this example the angular orientation has been rotated 90° so that 0° is vertical.

SECTION 5.1

PLT PTN plotting sample

MARCH 6, 1971
BEAM PATTERN THETA
TRANSPARENT

LEGEND
○ - 500.0
FREQUENCY



808 NO 0408 PLOT NO 1 DATE AUG 06

SECTION 5.2

PLT PTN program listing

2000 JOB 601 ~~44954401~~ 00.03 L MCCLEARY PLT PTN BEAM PAT1
MOUNT M3S=PLOT
FORTRAN

C * * * * * PLT PTN CONTROL ROUTINE * * * * *
COMMON / / XDATA(361), YDATA(361, 4,1)
COMMON / CMHEAD / THDMEM(6), IHEAD(12,3)
COMMON / NUMS / LPTS, MEMBER, NFAMLY, NHLINS
COMMON / CPL LRL / DTA LRL(4,2), IPK LRL(4,12)
DIMENSION IMODE(3)
DATA IDOLAR/5H \$ / 1230
DATA IN UNIT / 5 /

C***** USER SETS NHLINS = NUMBER OF HEADING LINES TO BE LOADED
NHLINS = 3

C***** LOAD IHEAD FOR PLOT HEADINGS
DO 4100 J = 1,NHLINS
READ(IN UNIT, 200) (IHEAD(I,J), I=1,12)
CALL SFLO(24, 6, I HEAD(12,J), IDOLAR) 1230
PRINT 201 , (IHEAD(I,J), I=1,12)
4100 CONTINUE
200 FORMAT(16A5) 1230
201 FORMAT(1X, 16A5) 1230

C***** LOAD IHD MEM FOR LEGEND TITLE
READ(IN UNIT, 200) (IHD MEM(I), I=1,6)
CALL SFLO(24, 6, IHD MEM(6), IDOLAR) 1230
PRINT 201 , (IHD MEM(I), I=1,6)

N TIMES = 1
DO 5000 I TIMES = 1, N TIMES

C***** USER LOADS INPUT DATA FOR LPTS, MEMBER, NFAMLY, X, Y, DTA LRL
MEMBER = 1
NFAMLY = 1

READ(5,99) NANG,ST ANG,DANG, FREQ,IHANG,IMODE(1),IMODE(2),IMODE(3)
PRINT 99, NANG,ST ANG,DANG, FREQ,IHANG,IMODE(1),IMODE(2),IMODE(3)
99 FORMAT(I10, 3F10.2, 5X,A5, 5X,3A5)
LPTS = NANG
M = 1
N = 1
DTA LRL(M,1) = FREQ
DO 8 L = 1, LPTS, 10
LLO = L
LHI = L+9
IF (LHI .GT. NANG) LHI = NANG
READ(5,100) (Y DATA(LL,M,N), LL=LLO,LHI)
PRINT 100, (Y DATA(LL,M,N), LL=LLO,LHI)
100 FORMAT(10F8.1)
8 CONTINUE
R QUAD = 90.
X = ST ANG + R QUAD
DO 18 L = 1,LPTS
IF (Y DATA(L,M,N) .LT. -39.5) Y DATA(L,M,N) = -39.5
X DATA(L) = X * 3.14159 / 180.
X = X + DANG
18 CONTINUE

C * * * * * INPUT IS NOW LOADED * * * * *
CALL PLT PTN

5000 CONTINUE

C * * * * * TERMINATE ENTIRE PLOT RUN * * * * *
CALL PLOT(0., 0., 999)
STOP
END

```

SUBROUTINE PLT PTN
C * * * * * PLT PTN (USING DISSPLA PACKAGE) * * * * *
C * * * * * GENERAL PROGRAM TO PLOT FAMILIES OF CURVES WITH LEGENDS * * * * *
C * * * * * PROGRAMMED BY L. E. MCCLEARY NUC CODE 601 * * * * *

C * * * * * DIMENSION AS FOLLOWS * * * * *
C * * * * * LOAD COMMONS / /, /CMHEAD/, /NUMS/, AND ARRAY DTA LBL IN CONTROL
C * * * * * WHERE L=LPTS, M=MEMBER, N=NFAMILY, H=NHLINS
C COMMON / / XDATA(L), YDATA(L,M,N)
C COMMON / CMHEAD / THDMEM(6), IHEAD(12,H)
C COMMON / NUMS / LPTS, MEMBER, NFAMILY, NHLINS
C COMMON / CPL LBL / DTA LBL( M,2), IPK LBL( M,12)
C COMMON / NO LOAD / YMIN(N), YMAX(N), YPLOT(L)

COMMON / / XDATA(361), YDATA(361, 4,1)
COMMON / CMHEAD / THDMEM(6), IHEAD(12,3)
COMMON / NUMS / LPTS, MEMBER, NFAMILY, NHLINS
COMMON / CPL LBL / DTA LBL( 4,2), IPK LBL( 4,12)
COMMON / NO LOAD / YMIN(1), Y MAX(1), Y PLOT(361)

DIMENSION IH LBL M(4)

COMMON / CM PLOT / I BUF( 200)
DATA NBUF / 200 /
DATA IETF/0/
DATA I PLT UN / 2 /

C * * * * * INITIALIZE PLOT BUFFER
IF(IETF .EQ. 0) CALL PLOTS(IBUF,NBUF, I PLT UN)
IETF=1

C * * * * * FIND MAX MIN OVER ALL MEMBERS FOR EACH FAMILY
DO 500 N = 1, NFAMILY
Y MIN(N) = 1.E30
Y MAX(N) = -1.E30
500 CONTINUE
DO 3000 L = 1, LPTS
DO 2000 M = 1, MEMBER
DO 1000 N = 1, NFAMILY
IF ( Y DATA(L,M,N) .LT. Y MIN(N) ) Y MIN(N) = Y DATA(L,M,N)
IF ( Y DATA(L,M,N) .GT. Y MAX(N) ) Y MAX(N) = Y DATA(L,M,N)
1000 CONTINUE
2000 CONTINUE
3000 CONTINUE

C * * * * * USE DISSPLA PACKAGE * * * * *

DO 5000 N = 1, NFAMILY
CALL BGNPL( N )
M = 1
DO 4400 L = 1, LPTS
4400 Y PLOT(L) = Y DATA(L,M,N)

C***** USER SETS I SCALE = 0 FOR SELF SCALING
C***** USER SETS I SCALE = 1 FOR USER SUPPLIED SCALES
I SCALE = 0
I SCALE = 1

IF ( I SCALE .EQ. 0 ) GO TO 4440

C***** FOR USER SUPPLIED SCALES,

```

C***** USER SETS R ORIG, R STEP, R INCH FOR EACH FAMILY

R ORIG = -40.

R STEP = 10.

R INCH = 4.

GO TO 4445

4440 CONTINUE

C * * * * SELF SCALING

CALL AXSPLT(Y MIN(N), Y MAX(N), 4., R ORIG, R STEP, R INCH)

4445 CONTINUE

C * * * * SCALES ARE NOW AVAILABLE FOR PLOTTING

R TOP = R ORIG + R STEP * R INCH

CALL R RANGE(R TOP)

CALL POLORG(R ORIG)

D INCH = R INCH + R INCH

ITITLE = 1

CALL TITLE(1H, ITITLE, 1H, 1, 1H, 0, D INCH, D INCH)

TH CONV = 1.

CALL POLAR(TH CONV, R STEP, R INCH, R INCH)

DO 4500 J = 1, NHLINS

4500 CALL HEADIN(IHEAD(1,J), 100, 2, NHLINS+1)

CALL HEADIN(1H, 1, 2, NHLINS+1)

CALL GRID(1, 1)

CALL MARKER(M)

I MARK = 0

I MARK = 1

CALL CURVE(X DATA, Y PLOT, LPTS, I MARK)

C***** USER SELECTS LEGEND FORMAT FOR ENCODE

4 FORMAT(F7.1, 'S')

ENCODE(20, 4, 1H LBL M) DTALBL(M,1)

CALL LINES(1H LBL M, IPK LBL, M)

IF (MEMBER .EQ. 1) GO TO 4901

DO 4900 M = 2, MEMBER

DO 4600 L = 1, LPTS

4600 Y PLOT(L) = Y DATA(L,M,N)

CALL MARKER(M)

CALL CURVE(X DATA, Y PLOT, LPTS, I MARK)

ENCODE(20, 4, 1H LBL M) DTALBL(M,1)

CALL LINES(1H LBL M, IPK LBL, M)

4900 CONTINUE

4901 CONTINUE

C***** USER SETS N LEGND = 0 FOR NO LEGEND

C***** USER SETS N LEGND = 1 FOR LEGEND

N LEGND = 0

N LEGND = 1

IF (N LEGND .EQ. 0) GO TO 4960

XLEGND = D INCH - 1.5

YLEGND = D INCH + .5

CALL LEGEND(IPK LBL, MEMBER, XLEGND, YLEGND)

CALL MESSAGE(1H MEM, 100, XLEGND, YLEGND-.2)

4960 CONTINUE

CALL HEIGHT(.10)
CALL MESSAG('0 DEG', 5, 0 INCH*.5-.10, 0 INCH+.10)
CALL ANGLE(90.)
CALL MESSAG('90 DEG', 6, -.1, 0 INCH*.5-.25)
CALL RESET('ANGLE')
CALL RESET('HEIGHT')

CALL ENDPL(11)

5000 CONTINUE

RETURN
END

\$END

\$DATA

MARCH 6, 1971\$

BEAM PATTERN THETA \$

TRANSPARENT \$

FREQUENCY\$

46	90.00	-2.00	500.00	THETA	TRANSPARENT				
.0	-.0	-.1	-.3	-.5	-.8	-1.2	-1.7	-2.2	-2.7
-3.4	-4.1	-4.9	-5.8	-6.8	-7.8	-9.0	-10.3	-11.8	-13.6
-15.2	-17.3	-19.7	-22.4	-24.9	-26.0	-25.0	-23.2	-21.5	-20.1
-19.0	-18.1	-17.3	-16.7	-16.2	-15.8	-15.4	-15.1	-14.9	-14.6
-14.5	-14.3	-14.1	-14.0	-13.9	-13.8	.0	.0	.0	.0

END

SECTION 5.3

PLT PTN additional sample

MARCH 6, 1971
BEAM PATTERN THETA
TRANSPARENT
0 DEG

LEGEND
o - 500.0
FREQUENCY

